A Northern Tour.

I HAD long been desirous of paying a visit of inspection to our Experimental Farm at Wollongbar, which is situated on the road between the towns of Lismore and Ballina, in the most tropical, or semi-tropical, district of New South Wales; and I have lately had a favourable opportunity of so doing.

I have also been anxious to visit a tick-infected district in Queensland, in order that I might see for myself the effects of this fearful scourge upon the stock, in view of the near approach of the ticks to the northern border of the Colony, and the necessity of preventing as long as possible their access to New South Wales.

The desired opportunity occurred recently, and I left Sydney, accompanied by the Chief Inspector of Agriculture, Mr. Campbell, on the 25th of April, for Brisbane, where I arrived at 10·45 p.m. on the 26th.

At the railway station Mr. J. V. Chataway, the Minister for Agriculture, met me, and we arranged to travel together to the Richmond River district next morning, and on our return to Brisbane proceed to Gin Gin Station, which is about 250 miles from that city, and about 30 miles beyond the town of Bundaberg.

Accordingly, we started by train at 7·45 a.m. from South Brisbane for Southport, a village or watering place on the coast, situated just opposite the southern extremity of Stradbroke Island, which forms a sort of natural breakwater, so that a snug and well-protected bathing place is available for visitors. Here, too, is an excellent sandy beach, which extends into calm water of the most beautiful tints of blue,

merging into green and wonderful tints between these colours. Along this beach are numbers of small wooden bathing houses, available for all who need them.

The country between Brisbane and Southport, with the exception of some good land about the Logan River, is similar in character to that of a great deal of the coast generally—hardwood forest, forest oak, and tea-tree swamps.

We arrived at Southport at 11 a.m., and after waiting there for about half-an-hour took coach for the Tweed Heads. About 3 miles from Southport we crossed Nerang Creek on a punt. This creek, although not of very great width, took a considerable time to cross, owing apparently to a peculiar contrivance over which the rope travelled. This was covered up with an old soap or candle box so carefully that I was unable to study the mechanism. We got safely across, and after a drive of about a quarter of a mile through a sandy belt emerged suddenly on the open beach, and drove right down on to the hard sand, over which the sea was rolling and beating.

For miles we drove along this beach, with the waves swirling under the coach and the horses' feet. The constant flowing in and receding of the water gave one almost a giddy sensation, and an occasional heavy breaker dashed the spray about the passengers; but the day was so beautifully fine, and the sea was so calm, that a ducking was really little to be feared. After several miles of beach we had to drive up the steep sandy bank inland to avoid a rocky headland, through a small forest of honeysuckle trees, over a grassy swamp, then back on to the sand again; but presently we turned inland again up a pretty glade to an hotel at Bawly Head, where we—changed horses.

Here the Inspector of Stock and Customs' Officer of Tweed Heads, Mr. Whitty, met me with his buggy. He induced me to drive with him for the remainder of the journey to Tweed Heads.

Soon after leaving the hotel we crossed Tullabudgera Creek, a broad sheet of water, deep enough to almost cover the wheels and bed of the buggy. The passengers in the coach immediately behind us seemed much amused at our appearance when we almost disappeared in the deepest spot, and they congratulated themselves at their elevated positions in the coach. However, we managed to get through without the least mishap, and ran away from the coach very speedily, along the sandy beach again, and over the narrow neck of land along the centre of which runs the boundary between New South Wales and Queensland. Here we passed through a gate in the barbed wire fence (lately erected to control the passage of stock from Queensland) to the little village of Cooloon, generally known as "Tweed Heads."

I enjoyed this unique drive of about 23 miles exceedingly, for it was most pleasant and something out of the common; and I enjoyed some splendid oysters which Mr. Whitty had kindly gathered whilst he was waiting for us at Bawly Point.

The little village here is a favourite watering place for the inhabitants of the Tweed River, and it is frequently visited by persons from Southport and Brisbane, the fishing outside the Heads being excellent. The southern headland was named by Captain Cook Point Danger,

for he noticed heavy breakers thereabouts, and close to the northern headland lies an island named Cook Island, in honour of that illustrious navigator. After waiting for about an hour we continued our journey in a small steam launch which leaves Tweed Heads for the town of Murwillumbah every evening at 4 o'clock. To get out of the bay into the channel was a puzzle, owing to the formation of sandbanks inside a long stone breakwater which has recently been erected to deepen the river. After several backings and going ahead our little steamer managed to weather the breakwater, and we proceeded without more trouble across the heads and up the river, stopping here and there to deliver the mails which we brought in the coach from Queensland. The further we advanced the more beautiful became the scenery; but, unfortunately, the days being short, we missed some of the best until the moon appeared and the light wind died away, when the reflections of the high banks and distant mountains in the quiet water were extremely pretty and interesting. Huge Mount Warning, a remarkable, isolated peak, could be seen distinctly, and seemed to dodge about everywhere. After enjoying this for some time I sat down, and what with the fresh sea air and the monotonous thumping of the engine I fell asleep, and, strange to say, Mr. Chataway fell asleep too; but we woke in time to enjoy a view, and a very pretty one, of Murwillumbah in the distance.

We arrived at Murwillumbah at a little after 7 p.m., and were met on the wharf by a number of the residents, and were glad to find a good dinner awaiting us at a comfortable hotel. In the morning, before breakfast, I took a stroll as far as the Agricultural Society's Show-ground, and on my return I found that the landlady had been much concerned about me, as there had been a slight misty drizzle. "My goodness me, if Mr. Cook hasn't gone out without his overcoat! If he only knew this district he'd have taken it, for it don't give you a moment's notice, and you get wet through if you don't take a coat!"

Fortunately the mist speedily cleared away, and we enjoyed a splendid day—cool and bright. After breakfast the landlord of the hotel drove the party to see as much of the country as my limited time would permit, for I had to meet a deputation at 11. Mr. R. C. Ewing accompanied us and acted as guide. We drove through part of the town, then along the old Lismore Road, up hill down dale, over a branch of the river, away over a long level stretch of country, and back to town, through hardwood forests thickly timbered with immense trees, and through the most exquisitely beautiful "brush" or "scrub," as it is termed. The drive was most charming. The distant Macpherson Range of mountains, most precipitous and rugged; huge Mount Wolumbin or Warning, and other high mountains; the Tweed River, and the wonderful luxuriance combined with the varied tints of the magnificent vegetation made such an impression upon me that I shall never forget the glorious pictures which opened out before us. Mr. Ewing introduced me to the "lawyer" palm, the terror of the bush, with its peculiar "tentacles" or prolongations of the leaves, which are covered with recurved spines, ready to tear the face and hands and clothes of any one bold enough to force his way through its tangled

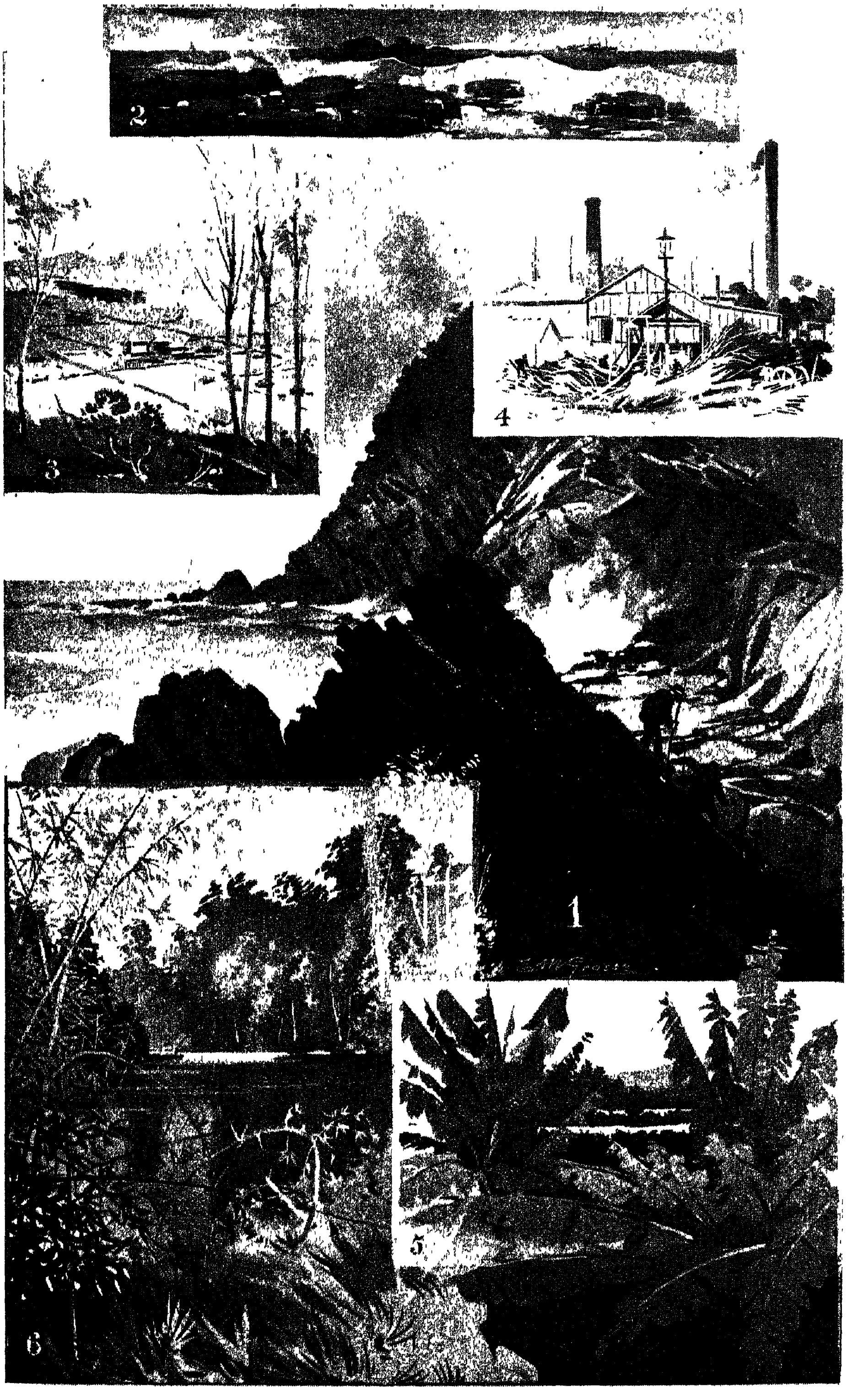
growth. Any one ignorant of botany would never think it was a palm. Its long canes are used for clothes lines, for basket-making, and many other purposes.

I was also introduced to the handsome stinging-nettle tree, a most abominable rascal, whose sting is said to make horses almost mad. If any one should be stung on the hand, not only does that member suffer, but shortly afterwards a pain occurs under the arm. Once upon a time, so Mr. Ewing informed me, a stranger to the district was stung severely on the hand. Some companions, for a joke, told him seriously that sometimes a sting proved fatal, a sure sign of a fatal effect being a pain occurring in the hollow of the arm some time after a sting on the hand. After a period of intense anxiety the pain under the arm came sure enough, and the poor wretch thought his end had come until his friends eased his mind.

We passed over a ford on the Middle Arm, one of the tributaries of the Tweed. This branch, as well as the other branches and creeks about, abound in perch, which attain a weight of 6 or 7 lb., and are said to be excellent for eating. Not very far distant from this crossing-place we came to a little settlement of Kanakas or South Sea Islanders, who, on the completion of their contracts with the sugar-planters in Queensland, had come over to this Colony, to work at the sugar plantations about the Tweed. It is said there are about 200 of them here, and that they demand, and are paid, the same rates of wages as the white men. Some few have leased sugar-lands, which they cultivate and thrive well on. We passed by three or four of their little farms, which looked well. One in particular showed indications of care and thrift. This is owned by a Kanaka named Murphy, corrupted to Mercy. Mercy has joined the Salvation Army, and is designated "Brother Mercy." He is now an ornament to the Army, and a capital collector it is said.

We continued on past these farms through a large "Foxtail" flat, covered with the coarse grass known as Foxtail, to the Queensland or Nerang road. Close to the junction of the roads is growing a magnificent clump of bamboos in an old garden. Here we crossed the tributary of the Tweed again, and shortly arrived in Murwillumbah again just in time to receive a deputation of members of the Agricultural and Pastoral Society of the Tweed. This deputation brought under my notice the necessity for an addition to the area of the show-ground, a request that the "Noogoora burr" and Lantana should be included in the list of noxious weeds, and matters in connection with the spread of the Queensland tick. The first two matters I promised to bring before the Minister for Lands; and as to the tick, I informed them that every attention was being given to the matter, and that all steps possible to delay its spread to this Colony were being taken, and most urgently advised every cattle-owner to take advantage of the visits of the officers who were then in the district giving object-lessons on inoculation.

Mr. Chataway, who was present, gave much information respecting the tick, and very kindly answered many questions. We then visited the butter-factory which has been established here, and on my way



A NORTHERN TOUR.

1. Cape Byron. 2. Juan and Julia Island from Cape Byron. 3. Tweed River near Murwillumbah. 4. Rous Sugar-mill. 5. South Arm, Tweed. 6. Brunswick River.

there was introduced to the Noogoora burr, a noxious plant closely related to the Bathurst burr, but said to be infinitely worse. It grows to a height of 5 or 6 feet, or even more, producing large, very prickly, burrs; and it grows so dense in some places as to impede farming operations.

It was first noticed at Noogoora, in Queensland, from which place it has spread through the southern part of Queensland, and is now making rapid progress through the Tweed district. I noticed it growing about the railway line to Lismore on its way to the Richmond River district which place will soon be infested, unless a vigorous check be placed on its progress. Mr. Campbell tells me that its botanical name *Xanthium strumarium*, the Bathurst burr being *X. spinosum*.

The butter-factory seems to be well managed, and is doing excellent work for the district. I believe the dairying industry will make great progress here before long, and probably many of the settlers will take it up in conjunction with sugar-cane growing. I was glad to hear that the farmers thoroughly appreciate the action of the Government in importing cattle from England. They are most anxious to obtain the services of several of the bulls, and will guarantee the full number of cows for three or four of any of the different breeds which can be spared.

We left this beautiful locality at 2·30 p.m. by train for Lismore, which is distant 61 miles, and were soon whirled into the thick of the magnificent primeval forest, then through a clearing here and there in progress, then through well-grassed farms, where the sleek cattle, knee-deep in the rich pastures, were browsing in happy contentment. Here and there large patches of sugar-cane appeared, and I noticed in several places isolated plants of cane were growing on the side of the railway, where probably pieces had dropped from the train when on their way to the sugar-mill. Every here and there too could be seen vines of passion-fruit trailing amongst the indigenous vegetation, apparently quite at home and able to compete with the native plants, and bear magnificent crops of luscious fruit of the finest quality. On we sped through deep cuttings, numerous tunnels, over the little Brunswick River, and then to the sandy stretch of coast with the coastal scrub of tea-tree, swampy places and bare sand; over Belongil Creek to Byron Bay, where lies a scattered village, a huge butter-factory, and the noted Byron Bay Jetty, which runs out into the ocean one-quarter of a mile.

As the train waited here for a quarter of an hour I was enabled to take a walk to the jetty and view Cape Byron, the most eastern promontory in Australia. It appears that the inhabitants of the Tweed Heads consider that the Tweed Heads should be the most eastern point, and are much aggrieved that it is not so.

I was glad to obtain some Sydney papers for the first time since leaving town, and anticipated a comfortable read in the train, but night set in all too soon, and lo and behold! the lamps in the train were so dismal that the situation became most tantalizing, until the good-natured guard, after witnessing our misery, and being unable to improve the light, ran off to the butter-factory and procured two sperm

candles, which Mr. Chataway with great art fixed up so effectively, that by the time of arrival at Lismore he and I were well posted up in current events.

We arrived at Lismore at 7·30 p.m., and were most hospitably received by the Mayor (Mr. O'Flynn), Bishop Doyle, and many inhabitants of the town, who conveyed us to the hotel where rooms had been provided, as well as a welcome dinner.

We were introduced to numerous gentlemen, who were extremely pleased that I had been able to pay the district a visit, and we made arrangements for the following day.

Next morning I visited the post office, a fine new building which had been erected when I held office as Postmaster-General, and I found from an inscription that I had laid the foundation stone (in spirit or by proxy !).

I was pleased with the appearance of Lismore, a busy, thriving town, destined doubtless to become, in the near future, an even more important centre that it is at present. It is situated on the banks of the Richmond River, into which its two tributaries, Wilson's and Leycester's Creeks flow, lying in a valley between beautiful hills, many of which are either cultivated or grassed to their rounded summits. I noticed sugar-cane growing on these summits as far away as the eye could reach. The progress of the town has been very rapid during the last few years, owing, in a great measure, to the enormous strides of the dairying industry. There are two very large butter factories and one large bacon-curing establishment within a mile or two of Lismore.

At 10 o'clock we started for a visit to the Experimental Farm, at Wollongbar, which I was anxious to see, and also determine whether it would be desirable to carry out the erection of proposed buildings, and extend the operations of the farm, which is distant 8 miles east of Lismore, on the road to the town of Ballina, the latter town being situated at the mouth of the Richmond, distant from Lismore 22 miles by road, or about 75 miles by river.

For about half a mile the road was fairly level; but after that the grade was very steep for a mile, and we ascended to a height of 500 feet to "the mountain," as it is termed. Here a most beautiful panorama opened out before us on each side. Magnificent indigenous vegetation, large areas of sugar-cane, and huge paddocks extending far away in the distance, backed up by undulating hills and lofty mountains—even the top of the cone of Mount Warning, at the head of the Tweed, could be seen quite distinctly. To the north Bexhill, Mayfield, and various other places, and to the south the Gundurimba Plains, whilst ahead to the east undulating open forest with farms all around, and to the south lay Lismore and the hills to the back. Beautiful indeed on this glorious, bright sunny day, lay one of the most fertile and magnificent districts in our favoured country. Until one actually visits this place it is difficult to realise its potentialities.

For the next few miles we passed through open forest country bearing splendid hardwood timber of tallow-wood, white gum, and and others, with grazing farms every here and there. At last, in the

distance, the farm came into view in the midst of the magnificent "brush or scrub," known as the "Big Scrub." Here the geological formation suddenly alters from slate to volcanic, from open forest to dense lofty jungle and tropical vegetation, the soil quite red, making a most marked contrast to the wonderfully beautiful and varied greens of the forest and the bright blue sky over all.

We soon crossed Merom Creek, one of the boundaries of the farm, and came into full view of the place. Here could be seen a varied collection of crops, all growing with great luxuriance, but I was sorry to see all this set off by a barbed-wire fence when something better would be a vast improvement.

We ascended a rather steep hill and arrived at the gates and were welcomed by Mr. Williams, the overseer, and the President and many members of the Alstonville Agricultural Society. Close to the gates, embowered in a very pretty garden, lies the manager's house. I regretted that Mr. Jackson, the manager, was obliged to be absent in Sydney in connection with departmental matters, and should have been pleased for his assistance in making myself acquainted with the progress of the farm.

In a paddock close by I found the imported Shorthorn dairy bull as quiet as a lamb and in excellent condition. He seems to be greatly in favour here. To an adjoining stable the Gurnsey bull had been brought for inspection. He too is in fine condition, and evidently well cared for. I then took a walk over the farm with Mr. Williams, overseer, Mr. Golding, one of the farm hands, and Mr. Campbell, and was shown the various crops and plants grown for object lessons and experimental purposes: Bananas of many varieties—Cavendish, Sossofa, red, plantains, and others; handsome coffee plants bearing heavily; mangoes, ramie fibre plants, sisal hemp, oranges, pine-apples, paw paw "apples," sweet potatoes, guavas, a dense crop of teosinte grown for silage; about seventy varieties of sorghum lately received from India, growing splendidly, and giving promise that most of them will be valuable acquisitions. Grasses of many varieties including Guinea-grass; Paspalum dilatatum, considered to be the best grass introduced into the district which yields enormously and stands grazing and drought better than other grasses; Paspalum Gulmarra, the Queensland Russel River grass, another excellent species; the Natal, or red top; Kentucky blue grass; and a few specimens of Mitchel-Grass, the finest grass known for dry districts.

Not far from these experimental grasses some paddocks of different kinds of grasses, Cocksfoot, Kentucky blue grass, Paspalum dilatatum, and mixed grasses, have been sown and fenced off to test their values under grazing, and so far the Paspalum comes out on top. It has been affirmed that under good management one cow, or even an average of one cow and a half, can be maintained on this grass to the acre, the year round, in this district.

I then visited the proposed site for new buildings, inspected a milling-shed, which is in course of building, and made inquiries as to future work on the farm; saw numerous varieties of sugar canes, many excellent new kinds which the Department of Agriculture had

imported from New Guinea; a fine collection of phylloxera-resisting vines which were imported last season from France, and which had succeeded well, giving promise of a good stock of cuttings for future use. Various other plants and crops were inspected, and all of these seemed to be thriving well. I was pleased at the absence of weeds and the well-cared-for appearance of the farm, which is a credit to the Manager and to the men in his absence.

After leaving the farm, we continued along the same road to the village of Alstonville, 4 miles further, where the Agricultural Society had invited me to meet them at a banquet. The country hereabouts has been cleared of timber, and for the greater part was under grass for dairying purposes, until we came to the Ocean View Hotel, for on the opposite side of the road the forest is in its original condition. We made a dive into this through a sort of tunnel, as it were, amongst the dense vegetation, bumping over logs, and banging through the bushes until I welcomed the order to get out and walk the rest of the way to the object of this scramble, the waterfall known as Marshall's Falls, a beautiful bit of scenery, which I consider should be resumed for public recreation.

Back again to the scramble, and then to the banquet which the hospitable Alstonvillers so kindly provided, and to which, I am sure, we all did full justice. After this we started off to see the country about the village of Rous, which lies south-westerly of Alstonville. We turned off the main road to the left, passing through most beautiful, undulating, and splendidly watered country; mostly cleared for dairying purposes. Many of the farms seemed to be sadly cared for; weeds and logs and stumps prevailing—poor economy and terrible waste. Here and there thrift and care were apparent; neat houses, with well kept little gardens attached, and great sleek cattle lazily "chewing the cud of sweet or bitter fancy," or taking their evening meal. As the sun dipped low and the shadows lengthened, the full beauty of this lovely undulating country was disclosed, and the thought of the luxuriance here, compared with desolation in our drought-stricken districts, arose forcibly in my mind.

Presently the little village, at first sight consisting of two hotels apparently, came into view, and then, after turning a corner, we drove up to the Rous sugar-mill, managed by Mr. M'Bryde, who had accompanied us from Lismore. That gentleman kindly showed me over the mill and explained its intricacies, but as the crushing season was over, everything was in disorder for clearing up, repairs, &c., &c., but I gained a good idea of the method of crushing the sugar-cane and making sugar. It seems that last season the cane yielded very little sugar indeed, for some reason or other, probably, it is thought, owing to cloudy weather during the growing season. Mr. Chataway, who is an authority on such matters, is of opinion that this was the cause.

I was obliged to cut my interesting visit short as the sun had set, and we had to travel 10 more miles to Lismore, so we hurried away, and arrived in town at 7 p.m., after a drive of about 25 miles through one of the most beautiful districts in the Continent of Australia.

At the hotel we met Messrs. Firth, Thow, and Harper, of the Railway Department, who had come on a visit of inspection of the railway line, and they kindly invited me to return by special train to Murwillumbah next day, which I was glad to do, and thus save a whole day; and besides this, I was enabled to see a great deal of the country which I had missed in the dark as I came to Lismore. After remaining at Byron Bay for an hour or two, we proceeded on our journey, and arrived at Murwillumbah about 8 p.m. Here I accepted an invitation to be driven overland to the Tweed Heads to see the country and views from the hills, and next morning we started at 6·15 a.m., after a speedy breakfast. Messrs. Thow, Firth, and Harper left by steamer for same destination about ten minutes ahead of us, and now it was a race between steamer and buggies. The sun was just rising, the clear air was crisp and invigorating, and the scenery most beautiful as we trotted speedily along the northern river bank. The growth of vegetation was singularly luxuriant, and I could hardly conceive it possible that the road along which we travelled was in daily use, for owing to growth of grass and weeds little or no track could be seen in places. I felt that if one were to stand still hereabouts for a day he would be smothered with weeds.

Presently we arrived at the crossing-place of the north arm just at its junction with the Tweed, and opposite the little village of Tumbulgum, where the punt was ready to take us across. We had passed the steamer, but as we were crossing it caught us again.

The scenery looking up the north arm was beautiful indeed, lit up with the early-morning sunbeams. The water was calm and clear, and reflected most exquisitely the background of mountains clothed with the richest of vegetation. A few houses on the opposite point greatly added to the effect, making altogether a remarkable picture.

We continued along the bank for some time, and then gradually ascended the hills amongst the brush-trees and sugar-cane farms, and as we rose higher and higher the most charming scenery came into view. The winding river like a silver band, the glorious vegetation, the yellowish-green fields of sugar-cane, with the huge mountains in the distance, made pictures never to be effaced from the memory. On the top of the hills I had an opportunity of seeing a very remarkable thing. The gentleman who was driving me had spoken about planting sugar-cane amongst stones and boulders with mattocks. This seemed to me to be a stretch of the imagination, until I actually saw the sugar-cane growing most luxuriantly between stones of all sizes—some enormous ones. There seemed to be no trace of soil, and how the cane grew so well seemed a puzzle, but there it was unmistakably.

Miles of beautiful rich country we passed through at full speed, then crossed another punt over Teranora Creek, and after another mile arrived safe and sound at our hotel, at Tweed Heads, having beaten the steamer by some ten minutes, to the discomfiture of our friends.

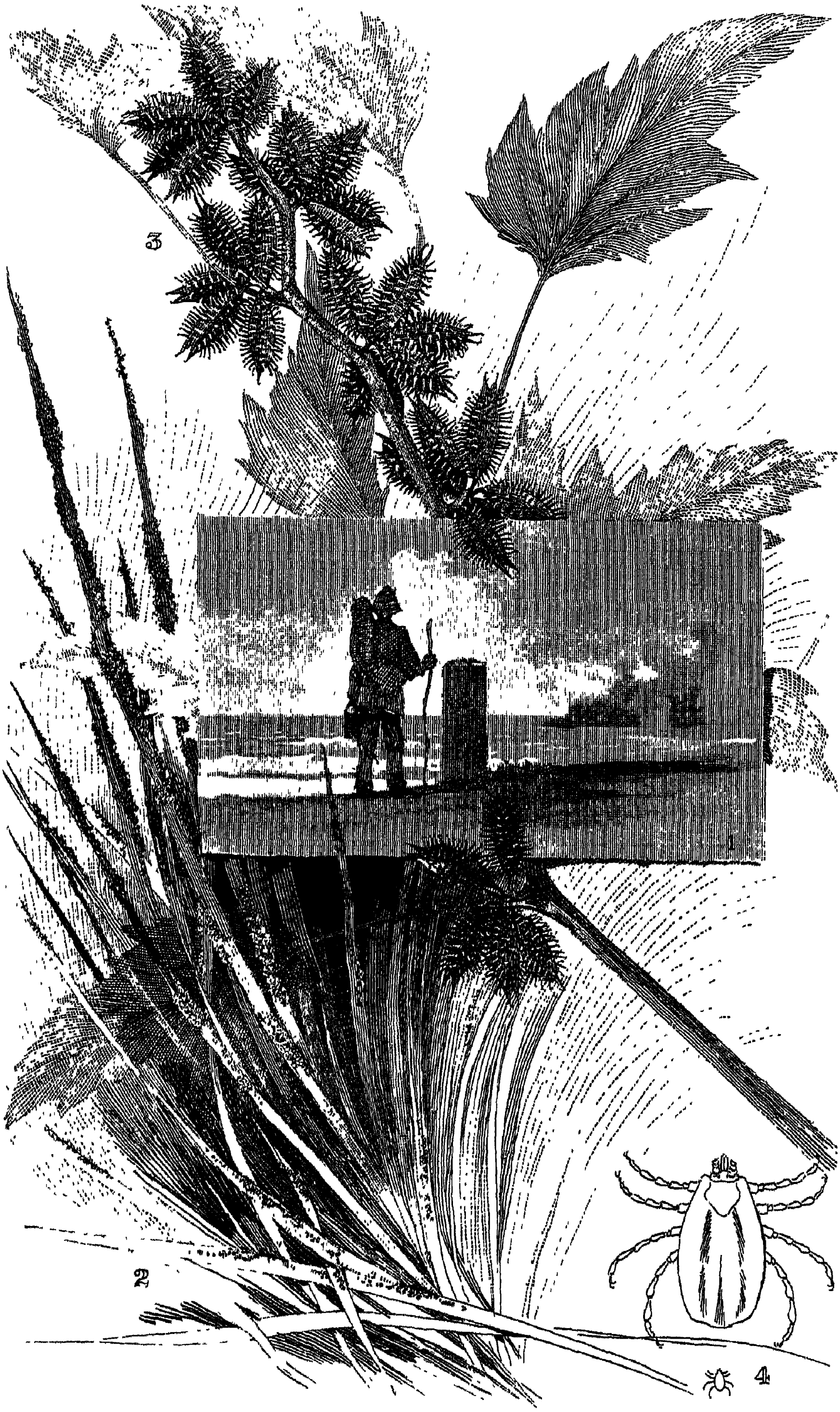
After another breakfast of excellent fish we took coach for Southport, and I again enjoyed the drive over the hard sand through the

breakers, amused at the thousands of seagulls diving after innumerable fish, which could be seen distinctly, as the waves rolled in.

At Southport we caught a special train which had been arranged by Mr. Chataway, and about 4·30 once more arrived in Brisbane. Here I took the opportunity of a stroll through the city, as I had no time to do so previously. There are many fine buildings here, notably the very handsome Public Offices, the Houses of Parliament, the Post Office, and the Banks. Near the Customs House I obtained a fine view of the river, with Kangaroo Point opposite, and felt much interested in the ferry-boats and little steamers plying across—a pretty scene in the gloaming, and I stood for some time enjoying it. The electric trams interested me also, and I jumped on one for a trial of about half a mile. I do not like the "spider's web" of wires across the streets overhead, and think posts, such as those in George-street, Sydney, are preferable.

At 8 o'clock that evening, accompanied by Mr. Chataway, Mr. Gordon, Chief Inspector of Stock, and Mr. Campbell, I took train for Bundaberg, where we arrived early next morning. We then took a special for Gin Gin Run, where the ticks are infesting the country to a considerable extent. We arrived at Gin Gin about 9 a.m., where we met the Inspector of Stock, Mr. McLean, his brother, who was experimenting with some cattle, and several residents of the village. This village is but a small one, containing, I should say, about 100 inhabitants. I was speedily introduced to the ticks, for Mr. McLean took a handkerchief, held it on the grass for about ten seconds, then brought it to me covered with minute or "larval" ticks! Then a blade of grass was brought. About 6 inches of the point was covered with dark-looking bunches, which, under a magnifying-glass, turned out to be thousands of ticks, clawing about vigorously, ready at a moment's notice to attach themselves to any unfortunate beast which happened to brush up against them. I was fairly staggered at this illustration of the stupendous numbers of these fearful pests. I may say that previously I had no conception of the probable hopelessness of endeavouring to block their progress south. I was then shown an unfortunate calf—a most pitiable object. The poor thing was a mass of sores and scab from tick irritation which must have been awful. Then a milking-cow—such a deplorable sight—infested by millions of small ticks, and thousands of huge, full-grown, hideous-looking creatures, sucking out its life's blood. I felt glad to turn away and drive on to the paddock on Gin Gin Run where Mr. McLean was carrying out his experiment. He had brought there twenty head of cattle. Ten had been inoculated, and the other ten had not been treated. The untreated ten very speedily died from the effects of the ticks. The remaining ten are gradually dying off; I think only two survived when we left.

As we drove on I noticed a group of horses which were exhibiting signs of irritation from ticks, biting at each other, switching their tails, and stamping the ground in great irritation. Soon after entering the paddock in which the cattle were located, we drove through a clump of saplings to a shallow lagoon, where we found three or four



TICKS AND BURRS.

1, The New South Wales-Queensland Boundary Post; 2 and 4, Ticks clustering on grass; 3, The Noogoora Burr.

dead cattle and two alive lying on the grass. Mr. McLean dismounted and approached one of them, which staggered to its feet, made a little run and a butt, and dropped down dead. To make sure that it was dead before a *post-mortem* examination, Mr. McLean pithed it, and then a remarkable thing happened. The ticks all started to leave the body! You could see the ugly creatures crawling off, like the blue army crabs on the seashore. The poor bullock was then cut open. His flesh was almost white, and no blood whatever flowed; the liver and kidneys were of abnormal colour, but the water in the bladder was perfectly clear, without signs of red-water.

It was sad, indeed, to witness the terrible effects of the ticks; to see the unfortunate cattle lying about in all sorts of contorted forms, with looks of agony on their faces; some with heads under shoulders; some with heads upturned, open-mouthed, and bursting eyeballs. Let me hurry away from this infested spot, and breathe the uncontaminated air once more.

We returned to Bundaberg to await the evening train, and I took the opportunity to visit a large sugar manufactory where sugar-refining was in operation; then in the evening we left for Brisbane, where we arrived in time for breakfast.

I visited the Agricultural Department and saw the Under Secretary, Mr. P. McLean.

In the evening we left for the Agricultural College, which has been established near the town of Gatton. It was about 8 p.m. when we arrived, too dark to see any of the country, but Mr. Mahon, the Principal, who kindly came to the station to meet us, said that there would be ample time next morning.

I found the College to be most pleasantly situated on a rather sandy ridge and overlooking a splendid tract of country.

The various buildings for the accommodation of students and staff have been erected with a view of separating the various offices as much as possible. There are two dormitory buildings, one laboratory, dining-room and kitchen, building for lectures, &c., and separate quarters for Principal, and separate buildings for each officer.

All these buildings are erected on high blocks—I might almost say piles—so that the floors are about 8 feet above the ground.

Use is made of the space under the floors—for instance, underneath one is a carpenter's shop for the students, where each one has the convenience of a tool-box.

Around each building shrubs and flowers have been planted, and altogether the College has a pleasant and cheerful aspect. The laboratory is most completely furnished for chemical instruction and work for the Agricultural Department. Here I met an old Hawkesbury College student, Mr. Nott, who has been appointed Assistant Chemist. He seems much pleased with his work, and retains great interest in the Hawkesbury.

We visited the land under cultivation, a rich alluvial flat extending along the banks of an overflowing creek. Here many kinds of crops are grown by the students, who perform most of the work. Here is a fine vegetable garden with all sorts of vegetables, magnificent healthy-

looking strawberries, and several kinds of fruit-trees. Potatoes do admirably here, and Mr. Mahon gave me an instance of one farmer who raised no less than 9 tons to the acre.

There are some fine dairy cattle kept; an excellent, beautifully-kept, and well-furnished dairy; a large piggery, just completed, and a fine building for the cutter in course of erection.

I regretted that my time was too short to permit of a more extended examination of the College, but I was much pleased and instructed with all I saw. We drove to Gatton, which is distant 4 miles, and caught the Sydney train at 10 a.m.; enjoyed the scenery ascending the Toowomba Mountain, and a view of the magnificent country known as the Darling Downs, which gives evidence of enormous potentialities.

After a trip of ten days, travelling day after day, and frequently at night as well, I find the distance passed over by rail, coach, and steamer, was 2,282 miles; and I returned to Sydney deeply impressed by all that I had seen of this most interesting portion of our continent.

Inoculation against Tick Fever.

Dr. Tidswell has submitted a further report on his experiments in connection with the inoculation of cattle for tick fever.

Mr. Cook considers the report very satisfactory, and remarks that the work hitherto performed by the officers concerned has had very direct and eminently practical issues. The general result is to the effect that inoculation may be safely performed without fear of damage to the cattle; that it is capable of affording valuable protection against tick fever; but that the protection has certain limits as regards degree, and more especially duration, the extent of which is not yet strictly determined.

A further series of experiments is about to be undertaken, but it is expected that their outcome will be to establish the limits, and more closely define the value of protective inoculation.

Formulæ for Preparing Fertilisers.

F. B. GUTHRIE.

THE formulæ here suggested may be taken as fulfilling the requirements of the different crops on average soil, and are intended to serve as a basis which may be modified to suit individual instances.

The proper manuring of farm-crops has been greatly neglected in New South Wales until within the last few years; and even now it is not unusual to hear doubts expressed as to the efficacy of manures, and recently some one has started the theory that their use tends to exhaust the soil, which is much like saying that a fall of rain tends to dry it up. Ordinary soil, under cultivation, becomes impoverished by the continual and periodical removal of the crops grown upon it without any attempt at returning to the soil the ingredients which have been removed by the crop. This is the function of manures; and if the phenomena attending the growth of crops and the movements within the soil were more under our control, the question of the application of manure in the proper form and quantity would become capable of accurate solution. The neglect of manuring in New South Wales has been due largely, I think, to the extensive areas cultivated and the difficulty of satisfactorily dealing with such large areas. This is notably the case with wheat, and wheat-farming on the large scale becomes a question of putting in the seed and reaping the grain and leaving the rest to chance. As long as this is the case the result will be uncertain and farming a precarious occupation. Although proper manuring is an essential to successful farming, it is not the only essential, nor is it the most important one. No amount of manuring will produce good crops on land that is undrained, sour, or in bad tilth. It is understood that the following suggestions as to manuring are to follow proper treatment of the soil, thorough cultivation, subsoiling, draining if necessary, liming, and green manuring. They presuppose a soil in good tilth, well limed, and well supplied with humus. There are so many excellent fertilisers on the market suitable for all classes of crops that it would be invidious to recommend any one in preference to the others; consequently, alternative formulæ have been suggested, so that one fertiliser may be replaced by another. The ingredients have been made up to ½ ton in each case, or 10 cwt., as a convenient basis for calculation if larger or smaller amounts are required. The calculated cost is based on the current prices in Sydney, and does not include freight. The prices are necessarily not exact, as substances like bone-dust, refuse, &c., vary considerably both in composition and price, but will be found to be fairly close. They should be a little in excess of actual prices, as each 100 lb. of manure has been priced as if it were 1 cwt. This margin will probably be found to about cover the freight; so that the figures given as cost per acre should be fairly accurate.

Fertilisers for Wheat.

No. 1.

	Quantity per half ton.	Cost. £ s. d.
Boiling-down refuse (containing 7 per cent. nitrogen, 9 per cent. phosphoric acid)	500 lb.	1 5 0
Superphosphate	500 lb.	1 1 0
Sulphate of potash	120 lb.	0 15 0
	10 cwt.	£3 1 0

Apply on average soil, at the rate of 3½ cwt. per acre, when seeding.

Each 100 lb. of the above mixture will contain—

Nitrogen... ... ... 3½ per cent.
Phosphoric acid... ... 13 per cent. (of which 8½ per cent. is water=soluble).
Potash ... ... 6¼ per cent.

This, applied at the rate of 3½ cwt. per acre, will give—

12¼ lb. nitrogen... ...
45½ lb. phosphoric acid
21⅞ lb. potash ... ...
} To the acre.

and will cost 21s. 6d. per acre.

Instead of boiling-down refuse, bonedust is substituted in the following formula :—

No. 2.

	Quantity per half ton.	Cost. £ s. d.
Bone-dust (containing 4 per cent. nitrogen and 20 per cent. phosphoric acid)	600 lb.	1 7 0
Superphosphate	350 lb.	0 15 0
Sulphate of ammonia	50 lb.	0 4 6
Sulphate of potash	120 lb.	0 15 0
	10 cwt.	£3 1 6

Apply at rate of 3½ cwt. per acre.

Each 100 lb. of this mixture will contain—

Nitrogen... ... ... 3½ per cent.
Phosphoric acid... ... 18 per cent. (of which 6 per cent. is water=soluble.)
Potash ... ... 6¼ per cent.

or per acre (3½ cwt. being applied)—

12¼ lb. nitrogen
63 lb. phosphoric acid.
21⅞ lb. potash.

at a cost of 22s. per acre.

In the following formula dried blood or "nipho" is used to supply nitrogen :—

No. 3.

	Quantity per half ton.	Cost. £ s. d.
Dried blood or nipho	300 lb.	0 18 0
Superphosphate	720 lb.	1 10 6
Sulphate of potash	100 lb.	0 13 6
	10 cwt.	£3 2 0

Nitrogen ... ... 3½ per cent.
Phosphoric acid ... ... 12¼ per cent. (all soluble in water).
Potash ... ... 5¼ per cent.

Applied at rate of 3½ cwt. per acre, this will give—

12¼ lb. nitrogen ... ...
43 lb. phosphoric acid...
18½ lb. potash ... ...
} per acre.

at a cost of 22s. per acre.

If nipho is used, the above is a very soluble manure and well adapted for applying as a top-dressing.

Using Thomas' Phosphate.

This is a form of phosphatic fertiliser which should be particularly well adapted to the class of soil most common in New South Wales, though it has not yet had a fair trial. Its merits are long recognised in Europe, where its cost is about £2 per ton for the highest quality.

Thomas' phosphate is not found to be so satisfactory on limestone soils as superphosphates, but in peaty soils, or on soils poor in lime, it is of especial benefit on account of the lime contained in it. It requires some care in mixing, as the lime it contains liberates ammonia from sulphate of ammonia; it must therefore on no account be mixed with this manure. There is less risk (but still some) of loss of nitrogen when mixed with bone and blood manures, nipho, &c. With potash salts, especially if finely ground, it has a tendency to dry to a hard cake.

Probably the best and most effective method of applying it is to sow broadcast, either before sowing or with the seed, say, at the rate of about 4 cwt. to the acre, applying the potash and nitrogen in soluble form as a top-dressing when the crop is above ground.

The formula for average land would be as follows:—

No. 4.

A. When sowing—

	£	s.	d.
Thomas' phosphate, 3 cwt.	0	13	6

giving a dressing of 60 lb. phosphoric acid to the acre.

B. Spring top-dressing—

	Quantity per half ton.	Cost. £	s.	d.
Sulphate of ammonia	400 lb.	1	16	0
Superphosphate	420 lb.	0	18	0
Sulphate of potash	300 lb.	2	0	6
	10 cwt.	£4	14	6

This mixture contains—

Nitrogen	8 per cent.
Phosphoric acid	7 ,,
Potash	15½ ,,

Apply at the rate of 1½ cwt. per acre (cost = 14s. per acre).

The crop, after the application of A and B will have received—

12 lb. nitrogen ... ... }
70 lb. phosphoric acid .. .. } Per acre.
23 lb. potash ... ... }

at a total cost of 27s. 6d. per acre.

Fertilisers for Fruit-trees.

The manuring of fruit-trees has recently undergone considerable modification, it having been found that the plant-food whose application is most beneficial is potash, and that it pays best to considerably increase the amount of this ingredient, the phosphoric acid and nitrogen being of less importance. It is better to limit the amount of nitrogen applied, and to apply this ingredient in quantity only if the tree requires it, and then in the form of a top-dressing, before the flowers are out, and not at a later stage.

All manures for fruit-trees should be well worked into the soil.

For Apples and Pears.

No. 5.

	Quantity per half ton.	Cost. £ s. d.
Bone-dust	520 lb.	1 3 6
Superphosphate	300 lb.	0 12 9
Sulphate of potash	300 lb.	2 0 6
	10 cwt.	£3 16 9

This mixture contains—

Nitrogen	2 per cent.
Phosphoric acid	15½ per cent (5 per cent. being water—soluble).
Potash...	15½ per cent.

Apply at the rate of 4 lb. per tree for young trees, at higher rate if the trees are older.

Four pounds per tree will cost about 3½d. per tree, or £1 10s. 6d. per acre if 100 trees are planted to the acre.

The above amount of nitrogen should be sufficient.

If the trees show want of nitrogen, if the leaves are not of a healthy green, sulphate of ammonia should be applied at the rate of about 1 lb. per tree as a top-dressing mixed with dry loam. The extra cost of the manure will be 9s. per cwt. or 1d. per tree.

For Stone-fruit.

Peaches, plums, apricots, &c., require rather more liberal manuring than the previous class of fruit. They show more readily want of nitrogen, and this ingredient should be applied in a more soluble form than is present in No. 5 formula. It is also important that it should be applied early in the season. This is the reason why slow-acting nitrogenous manures do not yield such good results, the nitrogen becoming available at a late stage of the crop, and the leaf-growth is increased at the expense of the fruit.

For Stone-fruit.

No. 6.

	Quantity per half ton.	Cost. £ s. d.
Sulphate of ammonia	250 lb.	1 2 6
Superphosphate	620 lb.	1 6 3
Sulphate of potash	250 lb.	1 14 0
	10 cwt.	£4 2 9

This mixture contains—

Nitrogen	5 per cent.
Phosphoric acid	10½ per cent. (all water—soluble).
Potash...	12½ per cent.

This should be applied at the rate of about 4 lb. to the tree, at a cost of a little over 3d. per tree. For older trees, a larger amount of fertiliser. Some long-continued and interesting experiments on the manuring of peach-trees were carried out by the New Jersey Experiment Station. A fertiliser of the above composition was applied at the rate of 6 lb. to the tree for a number of years (10 years). The results

are compared with those obtained on unmanured land and on land which had received a dressing of 20 tons of farmyard manure to the acre.

The average yield during the ten years was three times that of the unmanured land, and very nearly equal to the yield obtained by the enormous dressing of 20 tons per acre of farmyard manure.

The results obtained in an unfavourable season were even more striking. The yield in a bad year, 1899, which was only 11 baskets of fruit per acre from the unmanured plot, was 152½ baskets from that treated with the chemical manure, and 162½ from the 20 tons of farmyard manure. The farmyard manure contained eight times the quantity of nitrogen, four times as much phosphoric acid, and more than twice as much potash as the chemical fertiliser.

For Citrus Fruits.

No. 7.

	Quantity per half ton.	Cost. £	s.	d.
Bone-dust	520 lb.	1	3	3
Superphosphate	250 lb.	0	10	6
Sulphate of potash	350 lb.	2	7	3
	10 cwt.	£4	1	0

This contains—

Nitrogen	2 per cent.
Phosphoric acid	15½ per cent. (4 per cent. water—soluble).
Potash	18 per cent.

Apply at rate of 4 lb. per young tree, at a cost of a little under 4d. per tree, or £1 12s. per acre of 100 trees.

Fertilisers for Clovers and Leguminous Crops.

The power possessed by this class of crop of obtaining their nitrogen from the air renders the application of nitrogenous fertilisers of less importance than in the case of the other crops. This question is discussed at greater length in the Farmers and Fruit-growers' Guide, page 43. The growth of the root-nodules peculiar to leguminous plants depends upon the amount of mineral fertilising ingredients available, and the manuring necessary for this class of crop is one that supplies abundance of lime, potash, and phosphoric acid.

Liming at the rate of half ton to 1 ton to the acre is an essential to obtaining a successful crop unless the land is rich in lime.

For Leguminous Crops and Clovers.

No. 8.

	Quantity per half ton.	Cost. £	s.	d.
Bone-dust	150 lb.	0	6	9
Superphosphate	600 lb.	1	5	6
Sulphate of potash	400 lb.	2	14	0
	10 cwt.	£4	6	3

The above mixture contains—

Nitrogen	½ per cent.
Phosphoric acid	12 per cent.
Potash	20 per cent.

Applied at the rate of 3 cwt. per acre this will give the crop—

1½ lb. nitrogen...	per acre.
36 lb. phosphoric acid ...	
60 lb. potash	

at a cost of 25s. 6d. per acre.

The above dressing on land previously limed should give a full crop. Liming alone will be found of very considerable benefit.

The above fertiliser is for fairly good land, well supplied with vegetable matter. In soils poor in humus, a little larger dressing of nitrogen is necessary, in order to give the young crops a start, and supply it with the nitrogen necessary for its growth before it is able to obtain it from the air.

For such soils the following formula will be found good :—

For Leguminous Crops on Soils deficient in Vegetable Matter.

No. 9.

	Quantity per half ton.	Cost. £	s.	d.
Dried blood	150 lb.	0	13	6
Superphosphate	600 lb.	1	5	6
Sulphate of potash...	400 lb.	2	14	0
	10 cwt.	£4	13	0

This mixture contains—

Nitrogen...	2 per cent.
Phosphoric acid	10 per cent.
Potash	20 per cent.

and, applied at the rate of 3 cwt. per acre, will provide the crop with—

6 lb. nitrogen	per acre.
30 lb. phosphoric acid ...	
60 lb. potash	

at a cost of 27s. per acre.

The cost per acre for manuring leguminous crops according to the above formulæ is somewhat greater than for manuring wheat and fruit-trees. It is to be remembered, however, that such crops actually enrich the soil in nitrogen, and act as a nitrogenous manure even when they are cropped; so that if clover or cow-pea is grown alternately with wheat, the quantities of nitrogenous material required for manuring the wheat may be considerably reduced.

If such a green crop be ploughed under, it is equivalent to a dressing of sulphate of ammonia of 5 cwt. to the acre, which would cost about £2 5s., or of 9 cwt. dried blood (costing £2 14s.). This is of course in addition to the phosphoric acid and potash which is returned to the soil when the crop is turned under.

(To be continued.)

UITING BRANCH OF VALONIA OAK GROWN BY MR. GEORGE CUNNACK, CASTLEMAINE, VICTORIA.
(Greatly reduced.)

The Valonia Oak

(A TREE OF THE GREATEST IMPORTANCE TO TANNERS).

BY J. H. MAIDEN,
Government Botanist and Director of Botanic Gardens, Sydney.

THE following extract from the Sydney *Evening News* of the 5th May is self-explanatory :—

AUSTRALIAN LEATHER.—A NEW TANNING ADJUNCT.

IN view of the recent discussion of and prospective inquiry into the merits of Australian leather, it is of interest to find that a new, and possibly very valuable, tanning adjunct is likely to be acclimatised here, which will save a good deal of money from leaving the country, and at the same time establish a minor industry. At the invitation of Mr. A. H. Moore, of the firm of Messrs. Harrison, Jones and Devlin, several gentlemen connected with the tanning industry attended his office yesterday afternoon to inspect a specimen of the product which is the acorn crop of a variety of oak, scientifically named *Quercus ægilops*, and commercially known as Valonia. Among those present were Messrs. A. H. Moore, J. H. Maiden (Director of the Botanic Gardens), E. M. Farley (secretary), and J. Lawson (Executive Committee-man), of the Master Tanners' Association of New South Wales. Mr. Moore read the following letter, which, he explained, had been handed to him by Mr. Brearley :—"Castlemaine, April 28, 1899. G. Brearley, Esq., Melbourne. Dear Sir,—I am sorry I cannot give you further particulars of the introduction of the Valonia oak ; it is so long ago, I nearly forget. Anyhow, after repeated trials and failures with acorns sent from Smyrna in bags and boxes filled with earth, Mr. Cunnack decided to try the Wardian case. Accordingly Messrs. Powell had two of these cases made in London, and sent them to Smyrna to Mr. John Honischer, of that place. This gentleman had one case filled with young plants, and the other simply filled with earth and acorns. Both cases arrived early in 1880, and in splendid condition. Under the direction of the then Curator of the Macedon State Nursery, the young plants were planted out. Shortly after arrival the acorns in the other case commenced to come up, and after the first lot were removed, up came another lot, until I think every acorn produced a plant. These, in due time, were also planted out, and were distributed here and there. The Valonia oaks at Macedon, mentioned by Mr. Perrin in to-day's *Argus*, are the products of the plants in the first case. The plants, after remaining a season in Mr. Cunnack's garden, were planted out in one of his paddocks, where they have thriven fairly, and without any care. The trees first produced acorn cups about six years ago, and since that time have continued to bear an increased crop each year. The acorns have been distributed to Sydney,* Queensland, Adelaide, Melbourne, Geelong, Ballarat, Warrnambool, Portland, Port Fairy, Dookie, and this year some to Mildura. The greatest quantity have been sent to Ballarat, where, I understand, the Government are planting them on a large scale. The acorn cups are large, thick, good colour, heavy, and equal to the best samples of Smyrna. Mr. John Honischer writes :—'*Re* Valonia oak : The nature of the soil does not appear to be of great consequence, as the tree seems to prosper equally well on the hillsides and in the plains. It attains to the maximum height of 90 feet, and, I am told, in one of our Valonia districts, there is an old giant under whose shade 3,000 sheep can seek shelter. The practice of pruning the young trees is not resorted to here, and when the trees are very young they are often branched off near the soil, but as the trees grow the larger branches recede, and the trunk becomes more clearly defined. About ten years after the acorn has been planted it will commence giving two or three cups of Valonia, and not before fifteen or twenty years does the tree

* In a letter to me, Mr. Cunnack says that in 1880 Messrs. Saddington & Co., then of Wynyard-lane, Sydney, had two Wardian cases of Valonia, but the trees do not appear to have flourished, primarily because they arrived in bad condition, the cases having been opened on board ship. I have alluded to a tree in the State nursery at Campbelltown later on.

yield Valonia to any important extent. Baron von Mueller stated that among the many oaks produced from his garden nurseries, he raised for the first time in Victoria the Valonia oak. This I do not question, but the credit of first fruits, and in the free distribution of them, is most certainly due to Mr. George Cunnack.—Yours truly, ALEX. GOUDY." Mr. Maiden said that Valonia had been already introduced into this part of Australia, but owing to having been apparently wrongly planted as to climate, had failed to grow properly. There was no doubt if it was introduced into such districts as those round Exeter, Goulburn, and Bathurst, it would thrive. Mr. Moore said he hoped the Press would give the matter prominence, as it meant a real gain to the colony if taken up. The gentlemen representing the tanning industry concurred in Mr. Moore's view. The Valonia acorn cup was worth about from £15 to £20 per ton, and, as Australia now imported many hundred tons of it, the establishment of plantations of the tree here would mean—first, a great deal of money saved; and secondly, the eventual gain of an export trade. We understand that Mr. Maiden will at once plant some of the acorns—which are exceedingly fine—and report on their growth as early as possible.

Following are extracts from the evidence given before the Victorian Royal Commission on Vegetable Products in 1887, and show that the introduction of the tree into Australia is due to Mr. George Cunnack, tanner, currier, and leather-merchant, at Castlemaine, Victoria, while the Forest Department of the sister colony has done good work in causing the tree to be acclimatised. It will be observed that it supplements the information in the newspaper paragraph.

Question 8810. You desired that Mr. Cunnack should be written to on the subject? Yes.

The following letter was read:—

Castlemaine, 3rd September, 1887.

J. J. Shillinglaw, Esq., Melbourne.

DEAR SIR,—Your favour, 2nd inst., duly to hand; Mr. Dunn is in error stating that I have successfully cultivated *Myrobalans*. Possibly he may mean the Valonia or Levant oak, which I introduced into this Colony in June, 1879.

I had two Wardian cases sent from London to Smyrna. There one case was filled with twenty young rooted plants; the other, with a lot of acorns covered with earth. Both arrived here in splendid condition. The cases were opened under the inspection and direction of Mr. Ferguson, of Macedon State Nursery. At first the glass was removed a few inches; in a few days entirely. In about a week the plants were removed and set out. The acorns during the voyage had sprouted and produced some hundred or so of plants, which were set in rows in my garden, and afterwards distributed to our local Botanical Gardens, Macedon State Forest, Melbourne, Geelong, Ballarat and Adelaide Botanical Gardens, and to several private friends. Nearly all have done well, particularly those planted near Melbourne. I have a paddock planted with them, all of which are thriving, but growing very slowly, the most vigorous being 9 feet in height. Mr. Doran, at our local gardens, tried to bud the Valonia on the ordinary oak, without success, as the parent tree asserted itself. . . .—G. CUNNACK.

Following is the evidence of the late Mr. W. Ferguson, of the Macedon State Forest Nursery:—

Then there is the Valonia oak of Turkey (*Quercus ægilops*); that is a timber that ought to be extensively planted here. There are some tanning firms that have been importing it largely from Smyrna, and thousands of tons are imported to England—that is, the cups, not the seeds. The seeds are sometimes imported, but there is not so much tannic acid in them as in the cup that envelops the seed. I find it grows well here. I have some now that have grown several feet in a very short time. The cups of the acorns produce the Valonia. No leather can be finished without Valonia, and large quantities are annually imported from Smyrna for tanning purposes. The tree grows well in every part of the Colony, and should be largely cultivated That is one of the trees that I would recommend for the warmer districts of the Colony.

3962. You consider it adapted for the northern plains? I do; I think it would do better than down here.

3963. How do you recommend its propagation? By seed. It is a difficult thing to import oak seeds from outside the colonies, because they will not keep any length of time after maturity; they perish very soon after being taken from the tree. It is best to have the seeds sown in cases when they are sent away from other countries, and when they arrive here they are germinated. I found a gentleman who had imported them

here from Smyrna and Turkey—barrels and barrels of them—and he never got a plant to grow, and I advised him to try them that way—to get them sown in Wardian cases, and every plant arrived in excellent condition.

3964. Do you know of any trees growing in the Colony? Some at Castlemaine and those I am growing myself.

3965. Have you any supply of acorns from those? They are just beginning to shed a few acorns now. I got a few of them yesterday.*

3966. Do you propose to plant what you obtain? Certainly. It should be propagated by all means. In my opinion it will be a large industry in a few years hence.

3968. You are of opinion that, as a profitable industry, that might be gone on with here? I think so, with very little trouble; and I think many of the settlers on the northern plains might add to their income by growing those trees, as well as add to the shelter.

3969. You have no doubt about the tree growing well on the northern plains? None. I am certain it will grow there.

3970. What would you suggest as the best way of sowing and planting by those farmers? By procuring the seeds. It can be grafted on the oak. All oaks can be grafted on the ordinary British oak, just the same as the ordinary fruit-tree, but I question whether it would live so long as by sowing them from the acorns.

3971. Still, as there seems to be considerable difficulty about that, the other would do for all practical purposes? Certainly. I have trees now that are grafted, but I question whether they will live so long.

3972. What difference will there be? All grafted forest trees generally prefer to be on their own stocks. It is a difficult matter. There is a disease that takes place at the junction of the two grafts, and very often the tree dies without any apparent cause. The tree should in all cases be sown from the seeds, if possible.

There is a paragraph on *Quercus ægilops* in Mueller's *Select Extra-tropical Plants* which may be referred to, but it is not reprinted here, as it embodies no further information than is contained above.

"This important tanning material is in large use in this country (Great Britain). It consists of the acorn-cups of the Valonia oak, *Quercus ægilops*, Linn., and the commercial supply is derived apparently exclusively from Greece and Asia Minor. Valonia from these two sources is commercially distinguishable, and they are produced by distinct local forms of the Valonia oak. . . . The cups give from 25 to 40 per cent. of tannin."—*Kew Bulletin*, 1888, pp. 163, 164.

Messrs. F. Honischer, of London (Smyrna merchants), furnish the following information. It will be observed at p. 611 that Mr. Honischer assisted Mr. Cunnack to get his oaks:—

A good sample of Valonia should be composed of medium-sized cups, the rim or wall of the pericarp very thick, with the exterior spines small† and uniform in size. The cup,

* That would be seven years after sowing; but of course but few acorns are produced at first. Mr. Cunnack's plants and acorns (of which these formed part) were shipped from Smyrna on 19th December, 1879.

† The Australian-grown Valonia has not small "spines," as will at once be seen from the figure; but some experienced tanners in Sydney have told me that they see no reason why our "long spined" sort may not be, for their purposes, equal to the best. The fact is, as I show on page 616, that there are several varieties of the Valonia oak, and it is my intention, during the next few months, to ascertain from the best European authorities what the relative merits of the several varieties of Valonia are. The plate will be found to depict a small "spined" Valonia cup from an actual specimen in my possession, and this is very much like the figure of *Quercus vallonea*, Kotschy, depicted by Prantl, in Engler and Prantl's *Pflanzenfamilien*. In Prantl's figure (which, as will be seen presently, is the var. *Ungeri* of *Q. ægilops*), the "spines" are rather short and flattish. Mr. Cunnack, in a letter to me, says: "I have used Valonia for the past fifty years, and the cups from my acorns have, on test, given just as good tannin return as the best I have imported from Smyrna." This is most satisfactory, showing that we have excellent Valonia now growing in Australia. What the precise variety of *Quercus ægilops* it may turn out to be is simply one of botanical interest. It is also to be noted that the Valonia "spines," or "beard," break off in drying and handling, thus causing the long-bearded Valonia to take on the superficial appearance of some of the short-bearded sorts.

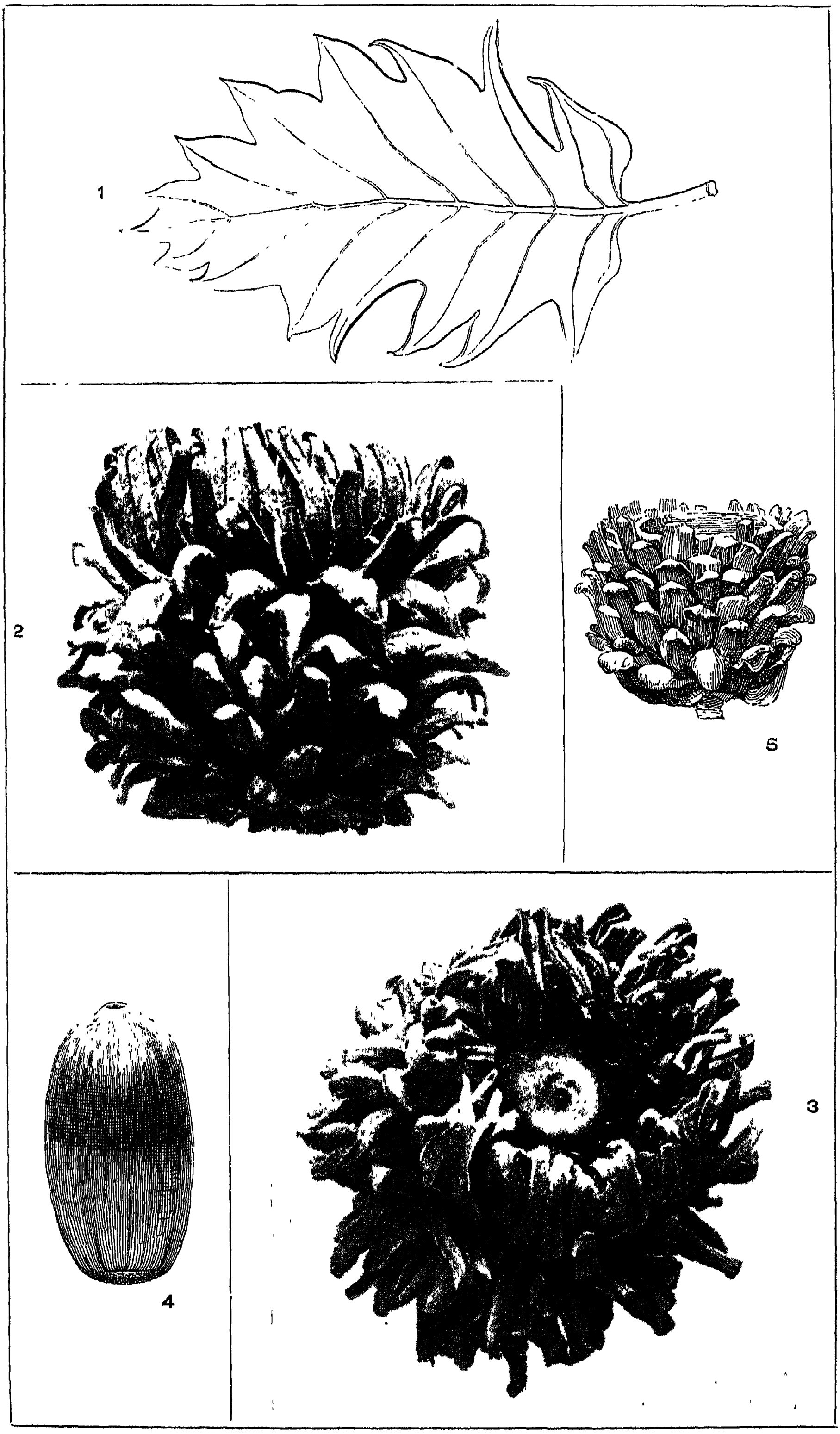
being cut or broken should give a bright drab fracture. The fruit ripens in July and August (northern hemisphere). When the trees are beaten the acorns remain on the ground to dry. The two oaks to which we are indebted for our supply of galls and Valonia, *Quercus infectoria* and *Q. ægilops*, grow side by side over a very large proportion of Asiatic Turkey, so that with a little attention a crop of both could be trebled. Valonia is valued by the tanner, because it imparts to the leather firmness and weight. When used alone the leather becomes too hard and brittle for general purposes; it therefore is almost invariably mixed with oak bark and other agents, such as *Myrobalans* and *Mimosa* (wattle bark). A good sample of valonia yields 26 to 32 per cent. of tannin.—(*Christy's New Commercial Plants and Drugs*, No. 5, p. 26.)

I have corresponded a good deal with Mr. Cunnack, and that gentleman has not only answered all my questions, but has very kindly placed at my disposal the letters and other documents connected with his original importation of Valonia oaks, together with other papers showing the continued interest he has taken in the acclimatisation of Valonia in Australia—his "hobby" he calls it. These letters and notes have not been previously published:—

"In Valonia we have many different qualities, which vary yearly according to the growth and of the crop. These qualities are likewise regulated according to the wants of consuming markets. Germany imports the best, which may be described as large, thick, heavy, evenly-grown, and of fine white appearance, and pays prices far higher for it than anything that is imported into the United Kingdom. The United Kingdom imports what may be termed the next best, and which is smaller in size, with a certain percentage of 'beard' (which falls off the outside of the cup), from 33 per cent. to 45 per cent., and must be of good whitish colour. Italy imports mostly the lower descriptions of the produce, or the 'refuse.' This is dark in colour, light in weight, and ill-grown. The nature of the soil does not appear to be of great consequence, as the tree seems to prosper equally well on the hill-sides and in the plains. It attains the maximum height of 90 feet, and I am told that in one of our Valonia districts there is an old giant under whose shade 3,000 sheep can seek shelter. The practice of pruning the young trees is not resorted to here, and when the trees are very young they often branch out near the soil, but as the tree grows the lower branches recede and the trunk becomes more clearly defined. About ten years after the acorn has been planted it will commence giving two or three cups of Valonia, and not before fifteen or twenty years does the tree yield Valonia to any important extent."—(Mr. John Hönischer, of Smyrna, Asia Minor, in a letter to Mr. George Cunnack, dated September, 1882).

Mr. Cunnack kindly gave me the following interesting particulars *re* Valonia, which he extracted from a trade journal:—The quality depends upon the neighbourhood whence it is derived. The qualities are:—

1. Uso Trieste.—Extra.
2. Uso Trieste.—Good.
3. Sifted.
4. Natural.
5. Uso England.—1st.
6. Uso England.—2nd.
7. Refuse; this nearly all to Italy.



1, Leaf; 2 and 3, Acorn Cups; 4, Acorn of Castlemaine grown Valonia; 5, Small spined Valonia Cup referred to at foot-note to page 613 (natural size).

"Yearly crop valued at £600,000. Sixty per cent. of this goes to England; Germany and Austria come next. The balance to Italy, Marseilles, and the North of France.

"The scales contain the same amount of astringent matter as the rest and the cup. Valonia is richer in tannin than Divi Divi, and preserves its good quality two to three years; during this time it loses 18 to 20 per cent. of its weight. The stouter the cups the more they are valued. In proportion as the cups decrease in thickness they become of less value.

"If the Valonia gets damp the colour changes to yellow or brown and loses many of its valuable qualities.

"The fruit is gathered in July and August (northern hemisphere) If north winds prevail, owners are liable to heavy losses.

"Small and imperfectly-formed cups are sold according to size. Those that are between that of a nut and a pea are designated *Camatia* or *Camatina*, and are nearly white in colour.

"Goods of the best quality must possess large thick cups, pleasant colour, toughness, weight, regularly-formed scales and unblemished appearance.

"The finest Smyrna is double the strength of much coast Valonia. Oak, Mimosa, and Valonia are stronger when grown on clay soil than on flinty or light sandy soils."

Following is the method of curing the Valonia:—

"The fruits when freshly gathered are placed in layers 3 to 5 feet in thickness under cover, with the view of causing some slight moist heating, merely to expedite the separation of the acorns from the cups, but this could perhaps be better effected by mechanical means, because the slightest overheating impairs the tannic properties. The fruits should be gathered in dry weather, and the cups be stored in places secure against dampness after the acorns have been removed, and the commercial industrial article (the cups) has been carefully dried. For ordinary Valonia the acorns are allowed to ripen, but for the more costly "*Camata*" they are gathered before ripeness. The fruits should be taken from the tree, as lying on the soil will soon spoil them."—(Baron von Mueller, in a letter to Mr. George Cunnack, dated April, 1893.)

"*Camata*," the small and imperfectly-formed cups, are sold according to size, between that of a nut and a pea, and are designated *Camata* and *Camatino*; they are nearly white in colour."

Following is the evidence of a tanner before the Commission already referred to:—

8809. Mr. Donovan referred to the importation of other materials besides wattle-bark? Yes; Valonia. That is all imported, and the price paid for it is £15 a ton by the masters here, and for every fifty hides (that is, tanned sole leather), there are 3 cwt. 3 qrs. of that used. It has been pointed out by the bootmakers, and by the tanners also, that sole leather tanned without Valonia is liable to let the water through; so it is necessary to tan with Valonia to make the leather hard.

Following is a description of the Valonia oak, taken from Nicholson's *Dictionary of Gardening*:—

"*Quercus ægilops*, Ægilops, Vallonea, or Velani Oak.—Flowers, greenish white; fruit-cup very large, hemispherical, with lanceolate, elongated, spreading scales; nut

brown, very ornamental; leaves, ovate-oblong, with bristle-pointed, tooth-like lobes, hoary beneath; height, 20 feet to 50 feet; Grecian Archipelago; evergreen, or nearly so. The cups and acorns are exported from the Levant in large quantities, being in great demand for tanning purposes. Syn. *Q. ungeri.*—Of this species there are two varieties: *latifolia*, with rather broader leaves, and *pendula*, with drooping branches."

The synonymy of the Valonia oaks is not easy to work out. That which is given below is taken from the "Hand-list of Trees and Shrubs grown in Arboretum (Royal Gardens, Kew), Part II," from which it will be seen that, besides the normal form, there are at least three well-marked varieties.

Q. Ægilops, Linn. South Europe, Orient.
Syn. *Q. græca*, Kotschy, *Eichen*, t. 30.
Q. ventricosa, Hort.
Var. *macrolepis*, Boiss. Crete, Greece.
Q. macrolepis, Kotschy, *Eichen*, t. 16.
Var. *Pyrami*, Boiss.
Q. Pyrami, Kotschy, *Eichen*, t. 3.
Var. *Ungeri*, Boiss.
Q. Ungeri, Kotschy, *Eichen*, t. 13.
Q. Vallonea, A.DC.

The full title of the work referred to above as *Eichen* (Oaks) is as follows:—Kotschy (Theodor): *Die Eichen Europa's und des Orient's.* Wien, Olmüz, 1858–62. Folio.

Another excellent work, which also depicts a number of oaks, is Hayne, F. G.: *Arzneikunde gebraeuchlichen Gewaechse.* Berlin, 1805–46. 14 vols. 4to.

Neither book is in the Colony at the present time, but I am taking steps to procure Kotschy's work.

A. De Candolle has monographed the oaks in Vol. XVI (Pt. 2) of the *Prodromus.* At page 45 he deals with *Quercus Pyrami, macrolepis*, and *Vallonea* (see Kew list), and at page 47, *Q. oophora*, Kotschy, which is one of the species also reputed as yielding commercial valonia. Full botanical descriptions are given in each case. A. De Candolle follows Kotschy in making *Q. ægilops* include *Q. macrolepis* (in part), and *Q. Vallonea* (in part).

I have hitherto been referring to the true Valonia oak (*Quercus ægilops*), but *Q. ægilops* is a name which is used loosely by some European gardeners to indicate at least two other very different oaks:—

1. *Q. lanuginosa*, Thuill., from Europe and West Asia.

2. *Q. cerris*, Linn., South and East Europe, Asia Minor, &c. The common Turkey or mossy-cupped oak. The confusion with the latter species is a specially serious one, as it is a good deal cultivated in this Colony—there are some fine specimens in the Sydney Botanic Gardens—and the Campbelltown tree went under this name until the fruits were sent to me, and I was able to make the correction. This may be a hint to friends in the country to examine oaks which have hitherto been known by them as *Quercus cerris.* The mistake is made in Europe as well as in Australia.

I find that I have a Valonia oak at the State Nursery at Campbelltown which has just fruited, producing about a dozen acorns. Its history appears to be unknown. It is 12 feet high, fairly healthy, and 18 inches in circumference at 2 feet from the ground. I suppose that it is the only one in the Colony, besides one grown by Mr. John Keep from one of the Messrs. Saddington's acorns. If there are others I should be glad to be informed. To the kindness of Mr. George Cunnack I am indebted for a fair supply of acorns, although, being so late in the season, most of the crop had already been removed from the trees. I have planted them, and have also distributed the few I could spare to responsible men in different parts of the Colony. Following are the townships near which they have been planted:—Sydney, also Chatswood and Wahroonga (North Sydney); State Nursery, Campbelltown; Picton, Moss Vale, Barber's Creek, Goulburn, Wagga Wagga, Dapto, Ulladulla, Bungendore, Cooma, Prospect, Mount Druitt, St. Mary's, Upper Kurrajong, Lawson, Mount Victoria, Mount Wilson, Jenolan Caves, Bathurst, Molong, Stuart Town, Coolabah, Bourke; State Nursery, Gosford; Quirindi, Walcha, Armidale, Tenterfield.

My readers may be certain that a serious attempt will be made to acclimatise the tree in New South Wales. As the supply of trees will be limited for a few years, I desire to put them to the very best use, and I propose to offer them to tanners, to those who have wattle plantations, and to nurserymen in various parts of the Colony. It appears to me that it will be found to be more generally suitable to New South Wales than Victoria, for it will flourish in country with poor rainfall, provided the winters be cold. The best Valonia comes from the mountainous country inland from Smyrna. It is a tree that should be very widely tested in this Colony, for it is an ornamental shade-tree, as well as one of the principal tan-yielders of the world, and when it is thoroughly acclimatised (of the possibility of which I have not the shadow of a doubt) the tanners of the Colony will soon take steps to purchase any Valonia that may be available. Valonia is an article for which there is great demand, especially in a leather-making Colony. I give this assurance, as cultivators are, from time to time, recommended to grow alleged economic plants by persons grossly ignorant of commercial products.

Just a word in conclusion. It is obvious, from what has already been stated, that the return from Valonia is not immediate. In many cases a man will plant for those who will come after him; this, nevertheless, will not deter enlightened citizens from planting a few trees. And while the Valonia is growing, do not forget the national tanning substance of Australia—wattle-bark. Wherever it will flourish, plant the broad-leaf wattle (*Acacia pycnantha*), just as you would plant the best kinds of fruit-trees you can get. It will grow splendidly as far north as Sydney. Where you cannot grow *pycnantha*, conserve and grow *Acacia decurrens*. Hurrah for wattle-bark! but endeavour to improve its quality year by year.

Native Food-plants.

By J. H. MAIDEN,
Government Botanist, and Director of the Botanical Gardens, Sydney

Part III.

[Dealing with Vols. IV and V of the *Flora Australiensis.*]

CAPRIFOLIACEÆ.

Sambucus gaudichaudiana, DC., and *S. xanthocarpa*, F.v.M. "Native Elderberry."

The fruit of these two native Elders is fleshy and sweetish, and is used by the aborigines for food.

All the Colonies except Western Australia (*S. gaudichaudiana*); Victoria, New South Wales, and Queensland (*S. xanthocarpa*).

RUBIACEÆ.

Coprosma Billiardieri, Hook., f. "Native Currant." "Morr," of the aborigines of Coranderrk Station (Victoria).

This plant bears a small round drupe, about the size of a small pea. Mr. Backhouse states that (over half a century ago) when British fruits were scarce, it was made into puddings by some of the settlers of Tasmania, but the size and number of the seeds were objectionable.

Tasmania and Victoria.

Coprosma hirtella, Labill. "Native Holly" (Tasmania).

Fruit sweetish, eatable, not agreeable. The fruits of other species may be eaten also.

All the Colonies except Queensland and Western Australia.

Sarcocephalus cordatus, Miq. "Leichhardt's Pine" of the Northern Territory.

The fruits are eaten by Queensland blacks—Thozet says they are very fond of them; also by those of the Northern Territory. (N. Holtze.)

Queensland and Northern Australia.

Timonius Rumphii, DC. "Kavor-kavor" of the aborigines.

The aborigines are particularly fond of this fruit, which has much the appearance of the crab or wild apple of Europe. (Thozet.)

Queensland and Northern Australia.

COMPOSITÆ.

Microseris Forsteri, Hook. "Murr-nong," or "Mirr n' yong" of the aborigines of New South Wales and Victoria.

The tubers were largely used as food by the aborigines. They are sweet and milky, and in flavour resemble the cocoanut.

Mr. Brough Smyth (*Aboriginals of Victoria*, i, 209) describes them as small, in taste rather sweet, not unpleasant, and perhaps more like a radish than a potato. Baron von Mueller has suggested their cultivation with the view to their improvement as a vegetable.

All the Colonies.

Picris hieracioides, Linn. "Täo" of the aborigines.

Sir Thomas Mitchell (*Three Expeditions*, ii, 149) thus speaks of this plant:—"Near our camp we found some recent fire-places of the natives, from which they must have hastily escaped on cur approach, for in the branches of a tree they had left their net bags containing the stalks of a vegetable that had apparently undergone some culinary process, which gave them the appearance of having been half-boiled.

"Vegetables are thus cooked, I am told, by placing the root or plant between layers of hot embers, until it is heated and softened. The stalks found in the bag resembled those of the potato, and they could only be chewed, such food being neither nutritious nor palatable, for it tasted only of smoke."

Then again: "There is a small cichoraceous plant with a yellow flower, named Täo by the natives, which grows in the grassy places near the river (Bogan), and on its root the children chiefly subsist. As soon almost as they can walk, a little wooden shovel is put into their hands, and they learn thus early to pick about the ground for these roots. . . ." (Mitchell, *Three Expeditions*, i. 336.)

In Southern Victoria, Mitchell also speaks of having found the root Täo, "usually found growing on the plains with a bright yellow flower" in the food-bag of a native (*Op. cit.*, ii. 270 and 272). He also states that cattle are very fond of the leaves of this plant, and seem to thrive on it.

Matthews (*Proc. Roy. Soc.* N.S.W., 1894, p. 103), speaks of Täo being the root of a plant called Pigweed (presumably *Portulaca*). This perhaps might be inquired into.

Mueller omits *Picris hieracioides* from his *Census*, thus expressing his opinion that it is an introduced plant; but is it not in the highest degree unlikely that our benighted aborigines of the interior, so early as the third decade of this century, would be found, when visited for the first time by a white man, to have the roots of an immigrated plant in daily culinary use?

All the Colonies. Not endemic in Australia.

Podolepis acuminata, R.Br.

Mr. Backhouse (*Narrative*, p. 504) records this as one of the plants which yielded sustenance to the Port Phillip blacks. It has a thickened root, compared by some to a potato.

All the Colonies except Western Australia.

Sonchus oleraceus, Linn. The genus *Sonchus* is omitted from Muell. *Cen s* Commonly called "Sow-thistle." It is the "Thalaak" of the East Gippsland aborigines.

The stems and roots are eaten (Hooker.) Leichhardt, in his *Overland Journey to Port Essington*, says that the young shoots of *Sonchus* made an excellent vegetable.

Throughout the Colonies. Not endemic in Australia.

GOODENIACEÆ.

Scævola Kœnigii, Vahl. It sometimes goes under the name of "Native Cabbage."

A large, succulent shrub, often met with along the sandy beach. It has large rich green foliage, and a vegetable might be made out of it. It is a common coast plant in the warmer parts of the world.

Queensland and Northern Australia.

Scævola spinescens, R.Br. "Pontoo" of Mount Lyndhurst tribe (S.A.)

The berries are eaten by the aborigines in South Australia. (Koch.)

All the colonies except Tasmania.

ERICACEÆ.

Gaultheria antipoda, Forst. var.

The fruit is of superior flavour. (Gunn.)

Tasmania.

Gaultheria hispida, R.Br. "Wax-cluster."

The fruit is eatable. The flavour is difficult to describe, but it is not unpleasant. The late Mr. R. C. Gunn states that in tarts the taste is something like that of young gooseberries, with a slight degree of bitterness.

Tasmania, Victoria, and New South Wales.

Astroloma humifusum, R.Br. (Syn. *Styphelia humifusa*, Pers.), and *A. pinifolium*, Benth. (Syn. *Styphelia pinifolia*, Spreng.) Commonly called "Ground-berry." In Tasmania the fruits are often called "Native Cranberries."

The fruits of these dwarf shrubs are much appreciated by school-boys and aborigines. They have a viscid sweetish pulp, with a relatively large stone. The pulp is described by some as being "apple-flavoured," though I have always failed to make out any distinct flavour.

All the colonies, except Queensland, *A. humifusa;* Tasmania, Victoria, and New South Wales, *A. pinifolia.*

Brachyloma depressa, Benth. (Syn. *Styphelia depressa*, F.v.M.)

The plant produces large crops of berries, about the size of small peas, which are eagerly sought for by the settlers of north-western Victoria for the purpose of jam and jelly making. The jelly made from the fruit is well flavoured, and of a rich claret colour, although when freshly gathered the fruit has a peculiar heavy, rather musky odour. (D'Alton in *Proc. Aust. Assoc. Adv. Science*, viii, 460.

Leucopogon lanceolatus, R.Br.

The fruits are red and very small, but pleasant to the taste. Sometimes they are borne in great profusion.

Tasmania and Victoria to Queensland.

Leucopogon Richei, R.Br.

The insignificant and barely edible berries of this shrub are said to have saved the life of the French botanist Riche, who was lost in the bush on the coast of the southern portion of this continent for fifty-four hours, at the

close of the last century. See *Bot. Mag.*, t. 3251, where a figure of the plant is given, and also an interesting account of the adventures of M. Riche on the occasion referred to.

All the Colonies (coast districts).

Lissanthe montana, R.Br.

The white, transparent fleshy fruits of this species are edible.

Tasmania, Victoria, and New South Wales.

Lissanthe sapida, R.Br. (Syn. *Styphelia sapida*, F.v.M.) "Native Cranberry." "Wild Apple" of children.

It is something like the cranberry of Europe both in size and colour, but its flesh is thin, and has been likened (*Treasury of Botany*) to that of the Siberian crab. It is of the size of a small cherry, coral-red, acidulous, and pleasant to eat.

New South Wales.

Lissanthe strigosa, R.Br.

The fruits are edible; they are smaller than those of *L. sapida*. They are of the size of small peas, white and sweet.

All the Colonies excepting Western Australia.

Styphelia adscendens, R.Br.

The fruit is eatable.

South Australia, Victoria, New South Wales, and Tasmania.

Styphelia triflora, Andr. "Five Corners."

These fruits have a sweetish pulp with a large stone. They form part of the food of the aborigines, and are much appreciated by schoolboys. When from a robust plant they are of the size of a large pea, and not at all bad eating.

New South Wales and Queensland.

Other species of *Epacrideæ* yield edible fruits of more or less value.

SAPOTACEÆ.

Achras australis, R.Br. (Syn. *Sideroxylon australe*, Benth. and Hook. "Black Apple," "Native Plum."

The rich milky sap resembles cream in taste; the fruit is nearly black, and like a very large plum, but somewhat astringent to the taste. The large seeds and the frequent occurrence of maggots in the fruit are drawbacks, but it yields a very fair jelly or preserve, frequently made in the country districts, where it is a prolific bearer.

New South Wales and Queensland.

Mimusops Browniana, Benth. (Syn. *M. Kauki*, R.Br.).

"*Mimusops Kauki* is another fruit-plant from these localities (Moreton Bay), and occurs abundantly; in perfect maturity the fruit loses its astringency, and is then by no means to be despised." (Mueller.)

Queensland.

Mimusops parvifolia, R.Br.

This tree yields a thick milky sap, which tastes like fresh cream. (Hill.)

Queensland and Northern Australia.

Sersalisia sericea, R.Br. (Syn. *Lucuma sericea*, Benth. and Hook.) "Wangi" of the aborigines.

The Hon. John Douglas, C.M.G., Government Resident, of Thursday Island, in a letter to me, states:—"The great fruit-bearing tree of these islands is the Wangi, so pronounced by the natives. It bears most abundantly a small date-like fruit, which is first scarlet, and ripens into purple. It usually grows close to the shore." The shape of the fruit may be described as between a date and a fig, and with one or more brown, shining, largish seeds, reminding one of loquat seeds. The abundant pulpy portion is not unpleasant, but rather insipid. The kernels of the seeds are persistently bitter.

Queensland and Northern Australia.

EBENACEÆ.

Cargillia australis, R.Br. (Syn. *Diospyros Cargillia*, F.v.M.), and *Cargillia pentamera*, F.v.M. (Syn. *Diospyros pentamera*, F.v.M. and Woolls. "Small Black Plum," "Illawarra Plum."

The fruits are the size of a small plum, and of a dark purple colour. They are eaten by the aborigines.

New South Wales and Queensland.

Maba humilis, R.Br. Native name on the Cloncurry, "Thankoin" and "Mogiore."

Yellow, oval fruit, $\frac{3}{4}$ inch long; very abundant on the tree; eaten raw by the aborigines. (E. Palmer.)

Queensland and Northern Australia.

Maba laurina, R.Br.

This tree bears green, palm-like fruit, which is edible. (Kennedy.)

Queensland.

APOCYNEÆ.

Carissa ovata, R.Br. (Syn. *C. Brownii*, F.v.M.). "Native Scrub Lime."

This little bush produces a very pleasant fruit, which is both agreeable and wholesome. It is like a sloe, egg-shaped, and about half an inch long. It exudes a viscid, milky juice, and contains a few woody seeds. "I can testify that the fruit is both agreeable and wholesome; and I never knew an instance of any evil consequences, even when they were partaken of most abundantly." (Tenison-Woods, vol. vii, 571, *Proc. Linn. Soc., N.S.W.*) It is a common article of food of the aborigines.

South Australia, New South Wales, and Queensland.

ASCLEPIADACEÆ.

Cynanchum floribundum, R.Br. Native name on the Cloncurry, "Thooromia."

In spite of its emetic qualities, is eaten by the natives in a raw state. (Mueller.) Pods and leaves full of milk; eaten raw when young. It is said to fatten the natives. (E. Palmer.)

Interior of Western and South Australia, Queensland, and Northern Australia.

Cynanchum pedunculatum, R. Br. "Kä-kümah" is the aboriginal name of the Larrakeeyah Tribe of the Northern Territory.

The seeds are eaten by the blacks of the Northern Territory, either raw or cooked over the fire. (N. Holtze.)

Queensland and North Australia.

Dæmia Kempeana, F.v.M. "Tau" of the blacks.

The flowers and buds of this plant are greedily eaten by the aborigines. They taste very like the seeds of the common marshmallow. I have eaten a number of them without the least ill effect. (Helms, in *Proc. Roy. Soc., S.A.*, xvi (3), 323.)

Interior of South Australia.

Marsdenia flavescens, A. Cunn.

The Rev. Dr. Woolls says the tuberous roots are edible. They are called "Native Potatoes," and the blacks were accustomed to eat them after some preparation. They are probably referred to in the following account of Captain Hunter's Expedition up the Hawkesbury, July, 1788 :—

"On the banks here we also found yams and other roots, and had evident marks of the natives frequenting these parts in search of them for food. They have, no doubt, some method of preparing these roots before they can eat them, for we found one kind, which some of the company had seen the natives dig up, and with which being pleased, as it had much the appearance of horse-radish and had a sweetish taste, and having swallowed a small quantity, it occasioned violent spasms, cramps in the bowels, and sickness at the stomach; it might probably be the cacada root." (*Historical Journal*, p. 153)

Victoria to Queensland.

Marsdenia Leichhardtiana, F.v.M. "Doubah" or "Doobah" (aboriginal name for fruits), which are called "Howla" in South Australia. In western New South Wales they are sometimes called "Native Figs."

The milky unripe fruits of this tree are eaten by the aborigines. In this state they are about the size of a large acorn, but more pointed at the ends. Sir Thomas Mitchell speaks of the aborigines as eating the fruits, seeds and all, but they were pronounced to be better roasted.

All the Colonies except Tasmania.

Marsdenia viridiflora, R.Br. Called "Native Potato" in the counties of Cumberland and Camden, New South Wales (Woolls).

A Werris Creek correspondent, whose name, I regret I have forgotten, wrote: "Native name, Kamibray dialect, 'Goobei.' Each plant bears several succulent tubers resembling potatoes, but more watery, and having a sweetish taste; much used in former days by blacks for allaying thirst."

New South Wales to Northern Australia.

Microstemma tuberosum, R.Br.

The tuberous root is eaten raw or cooked by the aborigines of the Northern Territory. (N. Holtze.)

Queensland and Northern Australia.

LOGANIACEÆ.

Geniostoma australianum, F.v.M.

The fruits are eaten by the Port Curtis (Q.) blacks. (Hedley.) It is worthy of note that this plant belongs to the natural order which yields *Nux Vomica* (strychnine) seeds.

Queensland.

GENTIANEÆ.

Limnanthemum crenatum, F.v.M.

The small, round tubers are roasted for food by the blacks of Northern Australia. (E. Palmer.)

In creeks and swamps in all the Colonies except Tasmania and Western Australia.

BORAGINEÆ.

Cordia Myxa, Linn. The "Sebesten Plum of India.

In India the tender young fruit is eaten as a vegetable, and is pickled. The ripe fruit is eaten, and is greedily devoured by birds. The kernel is eaten, and tastes somewhat like a filbert; that of the cultivated tree is better." (Brandis).

Queensland.

CONVOLVULACEÆ.

Ipomœa graminea, R.Br.

The tuberous roots are eaten by the aborigines of the Northern Territory. (N. Holtze.)

Queensland and Northern Australia.

Ipomœa pes-capræ, Roth. "Burkunbullum" of the Port Curtis Blacks.

The tubers of this species are eaten by the natives of the Port Curtis (Q.) district. (Hedley, in *Proc. Roy. Soc., Qd.*, v.)

Western Australia; also New South Wales to Northern Australia.

Ipomœa Turpethum, R.Br. Native name on the Cloncurry, "Kar-Kor."

"The seeds are large and black, enclosed in a transparent skin, generally three or four, smooth, with the angles rounded. The young buds are eaten raw when the seeds are white. They are very plentiful after the wet season, and are gathered by white people and boiled for peas." (E. Palmer.)

Queensland and Northern Australia.

SOLANACEÆ.

Lycium australe, F.v.M.

The aborigines of South Australia eat the fruits. (Koch.)

All the Colonies, except Tasmania.

Physalis minima, Linn. "Neen-gwan," of the aborigines of the Cloncurry River (North Queensland).

The berries are eatable. The plant is not endemic in Australia. Another species is the well-known "Cape Gooseberry."

New South Wales, Queensland, and Northern Australia.

Solanum chenopodium, F.v.M.

Fruits eaten in South Australia. (Koch.)

South Australia; New South Wales to Northern Australia.

Solanum ellipticum, R.Br.

The fruits are eaten in South Australia by the blacks. (Koch.)

All the colonies, except Tasmania and Victoria.

Solanum esuriale, Lindl. "Comyn" of the aborigines of the Lachlan River, New South Wales. "Oon-doroo" of those of the Cloncurry River, North Queensland.

The berries of this plant were eaten by the native guides of Sir Thomas Mitchell. (*Three Expeditions*, ii, 43.)

The size of a large marble, yellow; eaten by the natives of Northern Australia raw and roasted. (E. Palmer.)

Eaten by South Australian tribes. (Koch.)

Solanum hystrix, R.Br. Called "Walga" by aborigines in South Australia.

"The blacks use the fruit for food, but only with the pounded and baked bark of the mallee root, called 'Congoo' by them. Before using the fruit they take off the shell (the dry prickly calyx), and remove the seeds. This leaves a pulpy skin about the thickness of that of a native peach (? *Owenia*). The fruit and bark are then made into a cake. When fruits are not obtainable, and they are otherwise hard pressed for food, the natives bleed themselves in the arm, and use the blood with the bark. The natives told me, when opening the fruit for the seeds, not to eat the fruit, as it would make my throat sore, nor yet to touch my eyes with my fingers. The fine prickles and juice got into my fingers, and produced a good deal of pain and inflammation for a short time." (Annie F. Richards, in *Proc. Roy. Soc., S.A.*, iv, 136.)

South Australia.

Solanum nigrum, Linn. The fruits are called "Native Currants" in the Richmond River district of New South Wales.

Mr. Agard Hagman informs me that these fruits are used for making jam in the said district. It requires comparatively little sugar in its preparation. They were also used for food by the prisoners at Norfolk Island in Mr. Backhouse's time. (*Narrative*, p. 264.) Children often eat them. The leaves were cooked as a pot-herb by the camp-followers of Dr. Aitchison in Afghanistan. (*Trans. Linn. Soc.*, 2 Ser. Bot., vol. iii, part 1, p. 9 and 91.)

All the Colonies.

Solanum simile, F.v.M. Called "Quena" by aborigines in South Australia.

The blacks are fond of the fruit, but do not eat it until it has fallen to the ground. Both black and white men agree that to eat many will cause sickness. The fruit causes a hot burning taste in the mouth, but its scent reminds me of that of strawberries. (Annie F. Richards, *Proc. Roy. Soc. S.A.*, iv, 136.)

All the Colonies, except Tasmania and Queensland.

Solanum vescum, F.v.M. In Muell. *Cens.*, p. 95–6, *S. aviculare* and *S. vescum* are made separate species, but united in B. Fl., iv., 448. "Gunyang," or "Koonyang" of the Gippsland and other aborigines. "Meakitch" or "Mayakitch" or "Mookich" of the aborigines of Western Victoria (Lake Condah).

Its large fruit resembles a potato. The fruit when perfectly ripe, which is indicated by the outer skin bursting, may be eaten in its natural state, or boiled and baked. It has a mealy, sub-acid taste, and may be eaten in any quantity with impunity; but until the skin bursts, although the fruit may otherwise appear ripe, it has an acrid taste, and causes an unpleasant burning sensation in the throat. (Gunn.)

The berries of *S. aviculare*, Forst., which is a common weed in Queensland and New Zealand, are a deadly poison (Dr. T. L. Bancroft), although birds eat them with impunity.

"The Gippsland tribes collect the fruit of *S. vescum* eagerly. . . . It has much the appearance of *S. aviculare* (*S. laciniatum*, Ait.), the Kangaroo Apple, to which species it is, indeed, in habit so closely allied, that superficial observers seeing these plants growing promiscuously will hardly become aware of their distinction." (Mueller).

As it is obviously very important that two plants, one of which yields an edible and the other a poisonous fruit, should be clearly distinguished, I add the following notes:—*S. vescum* differs from *S. aviculare* in green but not dark purplish twigs; in sessile, decurrent, somewhat scabrous, and less shining leaves, while those of *S. aviculare* are distinctly petiolate, and, consequently, not decurrent along the twigs; in the more tender corollas, which are very slightly, but not to the middle, five-cleft, and hardly ever outside whitish; in thinner styles and filaments, the latter not shorter than the anthers; in more acute teeth of the calyx; in almost spherical transparently green berries, with large seeds. The berries of *S. aviculare* are at all times exactly egg-shaped, of an orange colour, and with seeds but half as large as *S. vescum*.

All the Colonies except Western Australia and Queensland.

MYOPORINÆ.

Myoporum debile, B.Br. "Amulla," of the aborigines.

The fruit, which is a quarter of an inch in diameter, is slightly bitter to the taste. It is eaten by the aborigines. (Thozet.)

New South Wales and Queensland.

Myoporum montanum, R. Br. "Myrtle-tree" (South Australia).

The fruits are eaten by the blacks. (Koch.)

All the Colonies except Tasmania and Western Australia.

Myoporum serratum, R.Br. (Syn. *M. insulare*, R.Br.) "Blue-berry" tree, "Native Currant" tree, "Native Myrtle," "Native Juniper," "Cockatoo Bush."

The berries are edible, though somewhat of a saltish and bitter flavour. They are much relished by birds.

All the Colonies except Queensland.

VERBENACEÆ.

Avicennia officinalis. Linn. "Mangrove"; "Egaie," of the Cleveland Bay aborigines; "Tagontagon," of those of Rockhampton; "Baa lunn," and "Tchoonche" are other aboriginal names.

"The fruit is heart-shaped, with two thick cotyledons. The aboriginals of Cleveland Bay dig a hole in the ground, where they light a good fire; when well ignited, they throw stones over it, which, when sufficiently heated, they arrange horizontally at the bottom, and lay on the top the *Egaie* fruit, sprinkling a little water over it; they cover it with bark, and over the whole, earth is placed to prevent the steam from evaporating too freely. During the time required for baking (about two hours), they dig another hole in the sand; the softened *Egaie* is put into it; they pour water twice over it, and the *Midamo* is now fit for eating. They resort to that sort of food during the wet season when precluded from searching for any other. (Murrell's testi mony,* quoted by Mons. Thozet.)

In salt-water estuaries all round the coast.

CHENOPODIACEÆ.

This Natural Order includes the salt-bushes and allied plants. Some salt-bushes (chiefly species of *Atriplex*) yield a fair substitute for spinach when boiled. The fruits of *Rhagodia* and *Enchylæna* are eaten by the aborigines, while the young shoots of the coast and brackish river plants—*Salicornia australis*, Soland., and *Suæda maritima*, Dumort.—are sometimes pickled.

AMARANTACEÆ.

Amarantus pallidiflorus, F.v.M.

Used by the natives of North-west Australia as a vegetable, like cabbage. (J. W. O. Tepper, *Proc. Roy. Soc., S.A.*, xviii, 16.)

Northern Australia from west to east.

POLYGONACEÆ.

Muhlenbeckia adpressa, Meissn., var. *hastifolia*. "Native Ivy." "Macquarie Harbour Vine or Grape," of Tasmania.

The currant-like fruits are sub-acid, and were, and perhaps still are, used for tarts, puddings, and preserves; the leaves taste like sorrel.

All the Colonies except Queensland.

Polygonum hydropiper, Linn. Native name on Cloncurry, "Booragoorah."

The coarse stalks are roasted, peeled, and eaten by the natives on the Flinders. (E. Palmer.)

All the Colonies except Tasmania and Western Australia.

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*Murrell was a shipwrecked sailor, who lived for seventeen years with the aborigines of Cleveland Bay, Queensland.

NYCTAGINEÆ.

Boerhaavia diffusa, Minn. Native name on the Cloncurry River, Northern Queensland, "Goitcho."

The root is a long, thin, glutinous yam, 15 inches long, straight; grows on sandy banks of rivers, and on sand-ridges on the Cloncurry and Flinders. Roots roasted whole and eaten; of a mealy, sweetish taste, and very nourishing. (E. Palmer.)

Eaten also by Central Australian tribes at the present day, and probably by aborigines over the greater part of the area over which it occurs.

All the Colonies except Tasmania.

LAURINEÆ.

Cassytha pubescens, R.Br.

The aromatic fruits are much eaten by children. The same may be said of other species of *Cassytha*.

All the Colonies.

Cryptocarya insignis, Bail.

Enclosed in large red and yellow fruit called "Bompan" by the Bellenden Ker natives. It grows on a tree 2 feet in diameter and 70 feet high. The nut is a favourite food of the blacks, who steep it in running water and roast. (Meston.)

Queensland.

Cryptocarya Palmerstoni, Bail.

Nut enclosed in a large fluted red and yellow fruit, growing on a tree rising to 150 feet, with diameter of 5 feet. Favourite food of the blacks, who name it "Tekkil" and "Coohoy" or "Coi." (Meston.) See Bailey's *Botany Bulletin*, No. 7.

Queensland.

PROTEACEÆ.

Grevillea annulifera, F.v.M.

The seeds are comparatively large, of almond taste, and the fruits are produced copiously. The shrub will live in absolute desert sands. (Mueller.)

Western Australia.

Helicia prœalta, F.v.M.

The nuts are called "Coohoy" by the natives of the Herberton table and. (See also *Cryptocarya Palmerstoni.*)

Mr. J. Banfield, of Townsville, has been kind enough to give me some nuts of this species, which are almost spherical, and up to 2 inches in diameter. They resemble the "Queensland nut" (*Macadamia ternifolia*), but are larger, and have thinner shells. The aborigines of the Herberton tableland are very fond of them, and get quite fat on them.

Northern New South Wales and Queensland.

Helicia Whelani, Bail.

"The nuts seem to be largely used by the natives of Bellenden Ker for food, as we found large quantities of the broken shells, as well as the whole nuts,

at all their camps" (Bailey.) Enclosed in a hard fruit on an umbrageous tree growing on borders of scrub at foot of mountains. The blacks macerate and soak the seeds in running water for a couple of days, then roast and eat. 25 feet high and 15 inches in diameter. (Meston.)

Queensland.

Hicksbeachia pinnatifolia, F.v.M.

Yields edible nuts, but tasting a little acorny. Being rather large, and of a bright scarlet colour, they are very showy.

Northern New South Wales and Queensland.

Macadamia ternifolia, F.v.M. "Queensland Nut." "Kindal-kindal" of some aborigines.

This tree bears an edible nut of excellent flavour, relished both by aborigines and Europeans. As it forms a nutritious article of food to the former, timber-getters are not allowed to fell these trees. It is well worth extensive cultivation, for the nuts are always eagerly bought. Is said to take seven years from the time the nuts are planted before the tree reaches maturity and bears fruit.

E. Andre, in the *Revue Horticole*, speaks very highly of this ornamental and useful tree. He says: "The ripe fruit, however, is more particularly interesting. Usually one of the two ovules is abortive, and the surviving one fills the whole of the interior of the shell with its white, firm, close-grained albumen, forming a kernel which is as crisp as that of a hazel nut, but has a higher aroma and a finer flavour. We have gathered and eaten these nuts in the month of December. *Macadamia ternifolia* is a tree which should be cultivated both from an ornamental and economic point of view. Even if it yielded no fruit, it would make a fine appearance in gardens in the south of France, where the specimens already planted have passed uninjured through winters as severe as that of 1890–91; but how greatly enhanced would be the interest and importance attaching to this species if we could look forward to the discovery of some feasible mode of inducing the trees to yield a regular supply of their pleasantly-flavoured nuts!"

Northern New South Wales (I have received it from as far south as the Macleay River) and Queensland.

Persoonia spp. "Geebung."

These fruits are mucilaginous, insipid, and slightly astringent. They are largely consumed by aborigines, and also to some extent by small boys. Geebungs when dead ripe have a flavour which may be compared to that of apples, but the flesh is very stringy, and they have very big stones.

Persoonia falcata, R.Br. Native names on the Mitchell, "Nanchee" and "Booral."

The fruits of an agreeable flavour, and is much sought after by the aborigines of the Northern Territory. (N. Holtze.)

Leichhardt draws attention to these fruits, which his party used for food.

Queensland and Northern Australia.

Xylomelum pyriforme, Sm. "Native or Wooden Pear."

The seeds are edible.

New South Wales and Queensland.

(To be continued.)

Bees, and How to Manage Them.

ALBERT GALE.

Appliances, and how to use them.

The advent of the bar-frame system of bee-keeping necessitated the introduction of a number of other appliances, all more or less necessary for manipulation, either to avoid the open warfare of the bees or to aid them in their labour, so as to adapt their work to man's better convenience or to obtain their produce with the least possible waste of bee-labour and bee-material. Apart from the poetic side of bee-keeping, there is undoubtedly a phase in it, whether it be indulged in as a hobby or as an industry, which sorely tests the patience of both men and women bee-keepers—not only their patience but also their courage. Ofttimes when the bees have asserted their supremacy, and put their enemy to flight, they, the enemy, do not feel the retaliatory courage necessary to renew the attack. Many a one whose heart and soul has been in the idea of bee-keeping, whilst he has been watching veteran bee-keepers handling their bees as if they were so many flowers, has given up that idea when he attempted to do likewise, because the bees resented the amateur's interference. Stings from bees are things that no one is desirous to indulge in.

The callous indifference of the practical bee-keeper, and the contempt he has for the little warriors, is all brought about by use—that is, by experience. We are told that we can get used to anything. Proverb hath it that the very eels get used to being skinned, so the practical bee-keepers get used to being stung, *i.e.*, their systems become inoculated against the virulency of bee-poison, but in their apprenticing-days all necessary care had to be taken before they could laugh at the danger arising from the action of a bee's sting.

Protection is the starting-point towards the consummation of perfect success in the handling of bees. The first part of the body that a bee tries to attack is the most vulnerable—the eye. Why, I cannot tell you. Perhaps the brightness or the sheen of it, or perhaps the quick movements of the eye and eyelids may suggest to the bee a challenge. At the best of times it is not nice to be stung about the eye. Between the eyes is one of the most painful points that can be assailed. I say one, because under the tip of the nose is another. I saw a gentleman stung on the last point named, and he sneezed nine times in succession. He was a big man, too, and it nearly shook his head off. After he ceased to sneeze, his eyes ran water for about half an hour.

Now in the first place protect the face. A veil is the orthodox thing. Whether veils are necessary or unnecessary is a question for the bee manipulator to decide, and the decision can only be arrived at

Advance Australia.

by experience. To me a veil is always a nuisance. It always more or less obstructs the vision, and as it is always best to look at your bees in the heat of the day, a veil prevents the free circulation of the air and you will feel something like suffocation. Always wear a veil! "Bosh!" you say; "I saw in last December *Gazette* Mr. Gale handling bees as freely as I can handle cabbage plants!" When you have had the experience that I have you will be able to do the same. Let your veil be large enough to come well down around you. Have a hat with a broad leaf or brim to it. A straw hat if it fits well is cool and comfortable. The veil must be made like a bag open at both ends with an elastic band around one, so that the veil will draw closely around the crown of the hat and hang loosely over the brim. Put your veil on and tuck it under your braces, or your vest, or even your coat, if you intend to protect the arms. When you have sufficient knowledge of the work, wear your veil thrown back over your head in readiness to cover up the face should occasion require it. American bee books give a list of about a half dozen different kinds of bee veils; Capeharts', Coggshall's, Martin's, Mrs. Axtell's, Mrs. Harrison's, Mrs. Holm's, &c.; but a piece of silk tulle, mosquito net, or Brussel's net, about 1¼ yard long, and sufficiently wide to encircle the shoulders so that they may have full play underneath is all that is needed. Whatever the material may be, in colour it should be black. If white be used a square of black should be inserted so as to be worn in front of the face, because black is more easily seen through than white.

One of the most convenient protections for the face is a veil sewn around the rim of a broad leaf hat, and the said hat to be kept in a handy place always ready for use. When the eyes only are to be protected a pair of close fitting goggles with wire sides and clear glass vision are admirably suited for the purpose.

If the arms are to be protected by a coat the cuff of it should be tied firmly around the wrist. Many bees will alight on the hand and crawl up the arm if this be not done; not with the intention of stinging but finding themselves imprisoned will retaliate with the only weapon they have available. With experience even this protection will be found cumbersome and unnecessary. Bare arms and the shirt sleeves rolled up above the elbow, will be found a better security against stinging than the protection I have described. If a bee alights on the bare arm, let it alone, it has not gone there for the purpose of stinging, and driving it off may irritate it into action. If a bee intends to sting the only notice it gives is a little sharper tone than usual. If it has made up its mind to sting it don't go fooling around before the final attack is made, it goes to business at once.

Then again some people protect the hands; rubber gloves are sold for the purpose. "A cat in gloves never catches mice," so says an old saw. You cannot handle frames, &c., so freely as is necessary with gloves on. Rubber gloves always keep the hands very hot. Better than these bee gloves, and cheaper too, are woollen gloves with a pair of cotton ones pulled over them and the gloves kept damp whilst you are manipulating. No bee will sting through them if so treated. The only material that appears to be impenetrable to the sting of a bee

is rubber or leather, but then the latter must be thick. Kid will not do; they will sting through it. Of course if the material be so thick that the sting cannot reach through it is right enough. The very first protection to be discarded should be gloves. I never wore a pair of bee gloves in my life, and in my early days came off pretty freely.

Now there is one portion of protection should not be overlooked. In a hive there are bees that have only just emerged from the cell as well as bald-headed veterans. When inspecting a hive and lifting out the frames there are bees on it of every age. Some of the older ones fly off and return to the hive, others cling to the comb under observation, some of the youngest bees try to imitate the actions of their older brothers to fly home but suffering from infantile weakness are unable to do so and fall to the earth.

If too young to fly they are not at all times too young to sting. These young bees when under a state of siege are very timid and become much frightened. When they have fallen to the ground their first impulse is to return to the hive as quickly as possibly. To do so they ascend any elevation with reach, among the most available being the lower extremities of the operator. These disturbed bees will clamber and invade the anatomy of the human form divine and finding all escape blocked, and the nether garment pressing upon them, in their turn become besiegers, and apply their tiny bayonet to some purpose and to the discomfort of the manipulator. There are many ways to check these unpleasant intrusions. Some put on a pair of bike pants, others tie the pants closely around the neck of the foot. When looking at your bees it is not always convenient to run and change your pants, nor is string always available. When a bee-keeper is manipulating he is always fairly well clad, especially on the lower extremities. He should always be adorned with at least boots, socks and pants. Therefore, the most handy and convenient way to protect your shins from those little crawling bees is to pull your socks over the leg of your pants; you are then made invulnerable.

Now, what I have advocated so far is protection to be used by the "lords of creation" who are trying to become lords of the bees. But the masters of the lords of creation are as good bee-keepers as their lords, or, if not, many of them are as anxious to become so. Most of the protections I have named are as applicable to lady bee-keepers as they are to men. There are dresses made specially for ladies. I have never seen one worn, and, therefore, I cannot tell if they give sufficient protection. Amateur bee-keepers, both men and women should be fully protected. But each article of protection should be discarded in turn. First learn to work with unprotected hand, next unprotected arms, followed by working with an unveiled face, that is with the veil thrown back over the head ready to be brought into requisition when required.

The illustration shows a very green novice setting out to take a swarm, and armed with some necessary and much unnecessary paraphernalia. In next issue I propose to show how the swarm his boys are tin-kettling can be most expeditiously and safely captured and hived.

(To be continued.)

Market in China for our Surplus Wheat.

THE Hon. the Minister for Lands (Mr. J. H. Carruthers) has received, through the Under Secretary for Lands, the following interesting report from Mr. Fred. Poate, District Surveyor at Tamworth:—

District Surveyor's Office, Tamworth, 5 May, 1899.

Sir,—I have the honor to inform you that my recent holiday was spent in the East; and, mindful of the needs of this Colony, I made numerous inquiries, investigations, &c., as to the possibilities of improving the present markets and opening up new ones for our coal, frozen meat, wool, and wheat or flour. The information obtained in respect of flour has such a direct bearing upon the policy of the Hon. the Minister for Lands that I have thought it desirable to place a short summary at your disposal for submission to the Minister, should you deem it of sufficient importance.

Wheat.—In the northern part of China wheat has to a greater or less extent been cultivated from time immemorial, and made into an inferior flour, which has been consumed in the surrounding districts.

Since the establishment of steam communication between America and China, flour in increasing quantities has been imported by the Chinese, principally for use in the southern part of China. The present importations range from 15,000 to about 20,000 tons a month.

On all sides there is evidence of the use of flour by the Chinese, and there is, apparently, no room for doubt that they are fast becoming a flour-consuming people.

The quantity of flour produced in the northern part of China is, and owing to the usages of the country must remain for an indefinite period, insufficient for local needs.

When travelling in the performance of my duties I am constantly asked what is the good of inducing people to go in for agriculture? Where is their market? Wait till we over-produce and see how the men now being encouraged to grow wheat will be snuffed out, &c., &c.; and when London seemed the only market, the question of the disposal of our surplus wheat often gave me anxious thought when selecting land for agricultural settlement and submitting designs, &c., for your approval.

With a nation of four hundred millions acquiring the habit of using flour, and situated within easy steam of the Colony, there should be no difficulty in disposing of our surplus wheat (in the shape of flour); in fact, thanks largely to the enterprise of the Americans, an unlimited market is opening for our wheat right at our own doors, as the colonies are so situated geographically as to be the natural producers of this food supply for China, being, *cæteris paribus*, from a week to ten days steam nearer Hongkong, the great distributing centre, than America.

Before we can do much in the China market, it is essential that we produce sufficient to enable us to keep up a steady supply; second, the flour must be prepared and put on the market in a way to meet, *not only the requirements, but also the prejudices of the Chinese.*

I am forwarding samples of the two principal varieties of Chinese wheats, in case it is thought desirable to experiment with them on any of the Government farms. The average returns of these wheats are about 25 bushels to the acre in good seasons, and the milling qualities are such that a large mill fitted with Simon's patent roller process has recently been erected on the banks of the Whangpoo River, about 5 miles below Shanghai. The samples were given me by the manager of the mill. No. 1 is Pootung wheat, grown on the low land between the Whangpoo and the Yangtsi. No. 2 is Wu Sie wheat, grown about 200 miles north-west of Shanghai. The Chinese inform me these wheats are never attacked by rust. It may be mentioned that Pootung wheat is grown on a crust of low-lying alluvial ground. This crust is from about 16 to 20 feet thick and lies on a bed of mud, which has been pierced to a depth of over 200 feet without finding bottom. In a natural state the ground produces very coarse grass and sedges.

After the ground is broken up, it is laid out in long narrow beds, the soil being raised so that the tops of the beds are some 8 or 9 inches above the intermediate spaces, much in the same way as the Chinese lay out their market gardens in this Colony.

Wu Sie wheat is grown inland, and the Chinese tell me the soil is poor, and in a natural state produces coarse grass and scrub; also, that the same method of cultivation is pursued as in the case of the Pootung wheat. As, however, I have not seen these inland wheat-fields, I can only speak from hearsay. [Arrangements have been made to propagate these wheats at the different experimental farms, and Mr. Poate is also testing them with a view to ascertaining their suitability for this Colony.] In February last, when I was at the mill, the company were giving 3s. 1½d. per bushel for these wheats.

Wool.—Wool of a coarse inferior description is grown to a considerable extent in Northern China; the exports range from thirty to thirty-five million pounds per annum. It is packed under hydraulic pressure in bales of about 600 lb. weight; about 80 per cent. is sent to the United States, about 12 per cent. to Japan, and the balance to London. The wool is plucked, not shorn, and used principally for carpets, &c. I have brought samples of six varieties with me, and shall be pleased to forward a small quantity of each if desired. [The samples will be examined by experts and a report published in due course.]

Frozen Meat.—There is a large business to be done in Hongkong, provided it is taken in hand by a competent business man with sufficient capital to erect cool storage, &c., &c. It is only necessary to point out that Hongkong is the head-quarters of our China Squadron (some thirty-five or thirty-six vessels), a General's station, and one of the most important ports in the world in respect of the number of vessels calling, to see the possibilities for the establishment of a successful and large business. It will be many, many years, if ever, before we can hope to send meat up there for the use of the Chinese.—I have, &c., FRED. POATE.

Dry Facts.

R. W. PEACOCK,
Manager, Coolabah Experiment Farm.

The Reclamation of Scalded Plains.

The advisability of reclaiming the many thousands of acres of land in the west coming under the above designation is being recognised.

That these plains are becoming larger every year and more numerous is apparent to all. And the pioneers of the fifties can look back upon the time when many such areas were covered with numerous saltbushes, cotton-bush, and various herbs and grasses, upon which fattened many of the cattle which brought such fabulous prices in the Melbourne and Sydney markets; but owing to the deterioration of the country the grazing of cattle has been well nigh abandoned, the merino taking their places, it being the better able to adapt itself to the altered conditions, being, besides, a more profitable animal where water and grass are so apt to become scarce.

If cattle, as in the early days, were still in possession, the scalded plains would not now be quite so numerous or extensive. The profits accruing from cattle depend almost entirely upon condition, while in the case of the merino flesh is not of paramount importance.

The close fastidious nipping of the sheep is calculated to eat out the best of the natural fodder plants, whereas cattle cannot produce the same disastrous effect. Where cattle would die sheep may thrive. The effects of the two different kinds of stock are very marked. I have noticed a sheep-station and a cattle-station adjoining, the former being covered with nothing but the rough tussocky grasses, the latter possessing a great diversity of forage plants, as in its primeval condition, a six-wire fence alone dividing these astounding differences. The horse-paddocks again present a marked contrast to the sheep-paddocks, horses being still closer feeders than are cattle.

In the sheep-paddock the scalded plain runs, with all its uninviting scarcity, right up to the fence of the horse-paddock, at which it stops abruptly, unable to proceed further without the aid of the too-closely huddled wool-producers.

The green shoot after rain likewise keeps its appointed place, but on the other side, so wonderful is the effect of a six-wire fence. With such painful object lessons, so numerous upon almost every holding, it may well be asked, "Why is not a rotation of stock more universally adopted?" The reason is obvious. It is no hard matter to rotate from cattle to sheep, the retrogression, as far as the pastures are concerned, being extremely easy. The subject assumes quite a different aspect when the reverse is attempted, it being well-nigh impossible to depasture cattle successfully upon an old abused sheep-

station. The retrograde step has been taken with its necessary concomitants—scalded plains and scanty pastures. Although the eating-out by sheep is one of the principal causes of scalded plains, there are other agencies at work, which are comparatively harmless unless in combination; the combined forces being droughts, winds, torrential rains, bush-fires, and excessive stocking with sheep. It is well known that during a drought the many shrubs, herbs, and grasses to some extent die, the dead roots not having the power of holding the particles of soil together.

The surface becomes friable and in minute particles, owing to the dry weather and tramping of stock, and is then carried away by violent wind storms with most of the decaying vegetable matter and seeds. What is left is then acted upon by heavy rains, which are unchecked owing to the absence of grass, and carry vast quantities of vegetable matter into alluvial deposits, the area of which is infinitesimal as compared with their source. Bush-fires at certain periods denude the surface of vegetation, which is readily acted upon by winds, &c., and if, at the beginning of a drought, the country so affected offers but slight resistance to the weathering agencies, the common result is that all the soil is swept and washed away, leaving a sour impervious sub-soil, lacking the mechanical condition and vegetable matter essential to fertility. In its perfectly bare and exposed condition it is impossible for it to retain any of the vegetable matter which from time to time is blown across it; as a result the barren area gradually becomes larger, covering, in many cases, hundreds of acres. Excessive rains also, by causing large sheets of water to accumulate for a sufficiently long period, destroy all vegetation, and if followed up by excessive dry weather may form the *nuclei* of many "scalded plains." During droughts such as we are at present passing through the many agents are observed carrying out their relentless work. One of the most disastrous effects of such a period is the wholesale destruction of seeds, which germinate after every shower, and perish for the want of sufficient moisture. This, upon country which during the last few years has had but few opportunities to reseed, is indeed calamitous, and it is a wise provision of Nature that grasses reproduce themselves under very adverse conditions and are so wonderfully prolific.

It is not surprising, therefore, that upon many places the country is not responsive to showers, especially during certain periods of the year. The climatic conditions which tend to make grass scarce during certain seasons must aid in the destruction of such grasses suitable for such seasons, especially when heavily stocked. During the spring grass is mostly plentiful, thus allowing many varieties to seed, whereas during summer grass is mostly scarce; and the stock prevents the seeding in some measure of summer varieties. To counteract these influences a system of sub-division could be followed to advantage, in which each paddock could be spelled alternately during a four-year course, thus giving the grasses and herbage of all seasons an equal chance.

Having looked into the many causes of this deterioration, it would be well to inquire whether many of the agencies could not be utilised

for the reclamation of these plains. I have heard many suggestions for the evil, but none have commended themselves to me. The principal one is that they should be ploughed or otherwise cultivated, and resown with grasses and saltbushes. Such a proceeding would be worse than useless in many cases, for, even if they were ploughed up thoroughly, the land is of such a nature that, after the first shower, the surface would run together like cement, and soon regain its former condition, and prior to the shower the wind would have even greater power than before. After giving the matter a good deal of consideration, it seems to me that the best method is the following :—To plough furrows about 6 feet apart across the fall of water, so as to impede the rush; some care must be exercised to carefully observe this point prior to commencing operations. The furrows may run very crooked, but the primary object must be kept in view, viz., to cause the water to lay in the furrows so as to deposit the vegetable matter contained in suspension. Also, if the furrows were 6 inches deep and the above distance apart, they would act as catches for the vegetable matter and soil blowing across by the winds, as well as for the numerous seeds transported by both agencies. The hard earth would also mellow down without danger of being blown away, it being retained by the furrows, forming, in combination with other detritus, a soil well calculated to provide suitable material for the germination and maintenance of seeds.

Saltbush seeds could be sown, as well as cuttings planted, and, if taken in a favourable time and from wood over twelve months old, would root readily, the furrows being an ideal place for the planting. If stock were kept off for a short time, the grasses, &c., would soon make headway, the roots aerating and binding the soil together. The young plants would retain the leaves of trees, grass-seeds, &c., and in a comparatively short time the whole space between the furrows would be covered with vegetation, thus utilising the principal agents, with the exception of stocking, which primarily caused the mischief. That such would result is seen from the fact that in old wheel-tracks across these plains grass is seen growing luxuriantly; but owing to the scarcity of such deep tracks they soon become filled up, and the protection they once supplied is, in consequence, nullified. That such a method would be comparatively inexpensive will readily be seen, the distances between the furrows to be left to the discretion of the landholder. I am sure the adoption of this method would very soon ameliorate such tracts of country, and handsomely repay the original outlay. As well as the furrows, bushes could be thrown over wherever practicable, and would act in the same way. The furrows possess the advantage of regulating the rush of water, which will be seen to be of very great importance.

I offer these suggestions trusting that they may get a trial, and would be pleased to receive many others from people interested in reclaiming these barren tracts; and I feel that if I have caused others to think seriously about this question, no small amount of good will be accomplished.

A Trip to Yarrawin.

During my recent visit to the abovementioned sheep station, I traversed over 70 miles of the, at present, drought-stricken area of north-western New South Wales, and had many opportunities of witnessing the struggle engaged in by the squatters of keeping the starving thousands of stock alive until rain falls in sufficient quantity to provide grass and water for the unfortunate animals. Yarrawin is the property of Dickson Bros., and is situated upon the western side of Marra Creek, and extends to within a few miles of Brewarrina. Starting from the Coolabah Experiment Farm my route lay across the Bogan River, thence to Marra Creek, continuing along the latter for about 30 miles.

Upon the western side of the Bogan the condition of the country is truly lamentable, the stock subsisting wholly upon the edible trees which are being felled for them. Thousands have already succumbed for the want of feed and water. Upon one property adjoining the farm 9,000 sheep are being scrubbed for. When first put on the scrub the weakest died, but latterly the majority are holding their own, and in some instances improving when fed upon such trees as "Supple Jack," "Kurrajong," "Mulga," and "Orange Bush." Crossing the Bogan, which was perfectly dry, we came to Mary Vale Holding, where about 20 acres of rich river land were being broken up, preparatory to the sowing of wheat for hay. Scrub-cutting was also actively engaged in, as upon all the holdings along the route.

Upon the eastern side of the Bogan a young shoot of grass was discernible on the low-lying patches, which had received more than their share of moisture from the rainfall of about an inch, in the beginning of April; but owing to the continued dry weather, this was burning off, and the cold weather coming on, the prospects for winter feed are indeed gloomy. At the present time with no grass, scarcity of water, and the supply of edible trees rapidly diminishing, the lot of the squatter in this district is not an enviable one.

Passing through Mr. Antill's station, which fronts both the Bogan River and Marra Creek, we noticed several windmills at work pumping water for the stock, from capacious tanks into troughing.

This system is strongly to be recommended as it makes the most of the water and there are no losses from the weak sheep bogging in the mud, which is of frequent occurrence at many of the tanks at which the sheep are allowed to help themselves. In one tank, which was almost dry, I saw, a short time ago, about 100 sheep bogged, fifty of which were dead; the others we helped out, some with their eyes picked out by crows, and upon our arrival many fat "gohannas" lazily took to the trees after revelling amongst the unfortunate wretches. Upon one holding I overheard the remark "that the scrub was cut off one paddock, and that the water would be done in another next week." Under such circumstances it was not surprising to meet dead-wool gatherers and skinners. And between scrub-cutting, skinning, and wool-gathering, numbers of men are employed. If the scrub is

fairly plentiful one man can fall enough for from 1,500 to 2,000 sheep per day; while others are employed keeping the animals up to the scrub.

Proceeding along the Marra, we filled our billy at the artesian bore which was put down some few years ago. The water is just trickling over the casing, about 3 feet above the surface of the ground. The squatters are rather anxious to learn more of the history of this bore. Though artesian water has been proved, the supply is problematical, and many squatters are desirous of having it tested further, prior to the expending of large sums upon their own holdings. They are awaiting the result of future proposed boring operations at the Coolabah Farm. Towards the end of our journey a green shoot of grass was more noticeable, until we reached the boundary of Yarrawin. Here the country presented a marked improvement in its appearance, the many salt-bushes having been conserved, Dickson Bros. considering the eating out of the salt-bushes as one of the greatest mistakes possible. They also have spared no pains in disseminating them throughout their run, which can be judged from the fact that they have gathered 2 tons of salt-bush seeds, the bulk of which has been distributed over the paddocks. The amount seems incredible, considering the lightness of the seeds, but I had the pleasure of seeing about 100 4-bushel bags full, which certainly required a lot of picking. The stock also presented a slight contrast to many others *en route.* Fat bullocks were there which had kept their condition upon the myall, as well as sheep which were well worth seeing, and it was hard to believe that they were passing through an almost phenomenal drought. The energetic owners have had twenty-five years' experience of western conditions, and have learned many useful lessons from the droughts of the past, which are standing them in good stead at the present time. They have given a lot of attention to their stud flocks, which are indeed superb, breeding principally from the Vermont and Rambouilet strains, their ideal being large symmetric frames, evenness of staple, density, lustre, and quality, as well as adaptability to their surroundings. And judging from the sheep I saw and handled, they certainly must have had a very exalted ideal if they have fallen short of it; and as to their adaptability to the climate, the following figures must speak for themselves. The whole flock of 70,000 cut an average clip of 10 lb. of greasy wool per head, the stud rams, young and aged, ranging from 20 to 34 lb., the latter being cut from a thoroughbred Vermont. Such amounts as from 25 to 30 lb. were surprisingly frequent. That these sheep are appreciated may be seen from the fact that many of the orders for rams cannot be filled, although from four to five thousand from selected ewes are bred annually.

That their losses this season have but very slightly exceeded the casualties of ordinary years is due to a thorough knowledge of the carrying capacity of their country, which has not been eaten out, and is estimated by Messrs. Dickson to carry one sheep to every 3¾ acres.

I am not one of those who consider that overstocking has solely caused the disastrous results of this drought, because there are many agencies at work which lead to the deterioration of even unstocked

country, but that such a practice seriously aggravates the evil will not be gainsaid. And that sufficient care has not been exercised in the past in the conservation of saltbushes, edible trees and grasses, as well as of water, will also be allowed. The growth also of farm crops has not been practised sufficiently as well, and one of the reasons of Dickson Bros. success is that they allowed the cultivation of cereals to play no unimportant part in the development of their holding. It rather surprised me to find upon the premises such up-to-date machinery as a rotary disc plough, seed and fertilizer drill, a string binder, and a steam chaff-cutting plant, with self-packing apparatus. These implements have been used in the cultivation and harvesting, &c., of the many tons of hay they have grown upon the station.

They were fortunate enough to have on hand at the beginning of the drought 300 tons of hay of their own growing, which would have cost, delivered on the station at the present low prices of produce, over £2,000.

This supply has just run out, and they are buying feed from elsewhere, and are at present feeding fifty-six horses which are required for the work on the station.

A portion of this hay was grown by irrigation, the water being supplied from the Marra Creek, which has been dammed by an overshot dam, and is first used to scour the wool at the woolscouring establishment belonging to the station. Last season the crop from the irrigated paddocks cut 25 cwt. of hay to the acre, the other paddocks resulting in failure owing to the almost unprecedented conditions. Some splendid crops have been grown without the aid of artificial watering.

The irrigation paddocks are situated upon the black soil, whilst the ordinary paddocks are upon the red. They have also grown good samples of oaten hay by irrigation (it would be an altogether too risky a crop without, as oats are surface rooters as compared with wheat, and not so drought resistant).

Oats were being drilled in at the time of my visit along with about 1½ cwt. of phosphatic manure to the acre. If such a progressive policy were followed upon many other of the western holdings, the drought would not have it all its own way, and perhaps the present season may teach many valuable lessons, amongst them being a more rational system of stocking, the growth of better animals, the improvement of the pastures, the conservation of saltbushes, edible trees and shrubs, and the better conservation of water, which would minimise the probability of future losses, which are so disastrous individually and nationally.

Report of a Visit to the Western District.

J. L. THOMPSON,
Travelling Agricultural Instructor.

I PROCEEDED to the Western District on the 1st of May, and acted as judge of farm produce at the Wellington Show on the following day. There was a magnificent display of wheat—twenty entries in one class, all of exceptional quality, and it required the utmost skill to determine the awards. The first prize was given to a magnificent sample of Steinwedel wheat, weighing 67 lb. to the bushel. A new show-ground, situated 1 mile from the town, was used for the first time, although the improvements are far from complete.

The district of Wellington contains an immense area of magnificent wheat-growing land. One gentleman has embarked extensively in this enterprise; this season he will have between five and six thousand acres under cultivation, and the results are generally highly satisfactory. I was told on the best authority that he has cleared over £3,000 per annum during the last few years, and refused a high price for his property which would have left him a handsome profit in his total expenditure up to date. The farm is under the management of a thoroughly practical and energetic agriculturist.

Needless to say, all the labour-saving implements and appliances, such as traction engines, disc ploughs, travelling chaff-cutters, and seed drills are used. He believes in deep cultivation and thorough pulverisation of the soil, and the selection of the best seeds. There are numerous other well-cultivated farms in the Wellington District.

On Friday I proceeded to and lectured at a small township named Bodangora (late Davisville), where the chief industries carried on are mining and agriculture. The latter is in its infancy, but there is a number of new settlers who are eager for information. I lectured in the public school, and had a most appreciative audience, some coming all the way from Wellington.

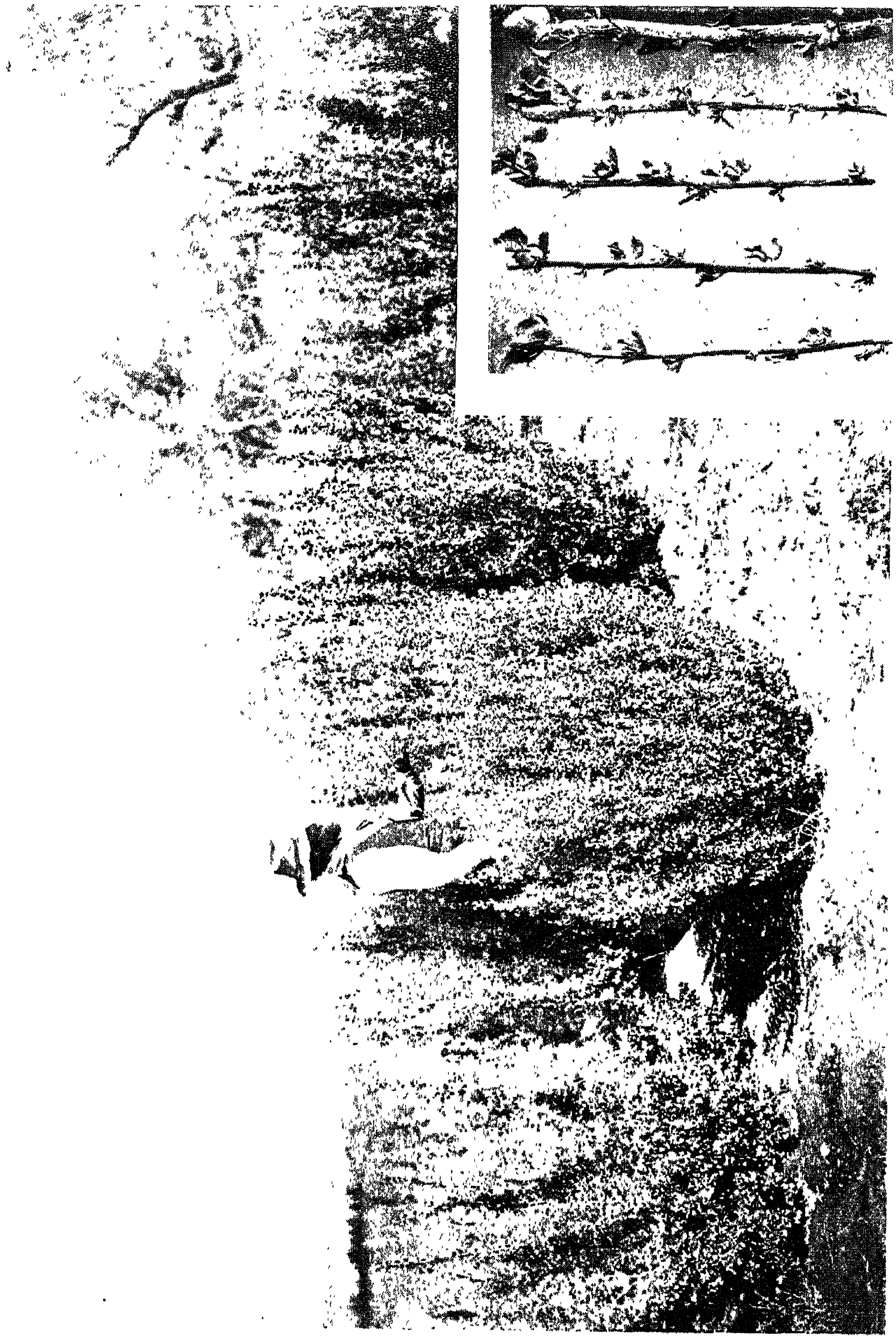
On Saturday, 6th, I acted as judge of a ploughing contest at Dubbo, where four, three, and two-furrow ploughs were entered for competition. The Spalding-Robbins rotary disc plough made by far the best work on the ground, turning up the soil in a splendid manner. On Tuesday, 9th, I acted as sole judge of agricultural implements at the Dubbo show. Without exception, there was the finest display of modern agricultural implements and appliances I have ever seen out of Sydney, seventy-one railway truck loads being on the ground. All the best firms from New South Wales, Victoria, South Australia, and New Zealand were represented. I was confronted with great difficulty in making my awards; as an example, fifteen double-furrow ploughs, all of exceptional workmanship, and well suited for the work for which

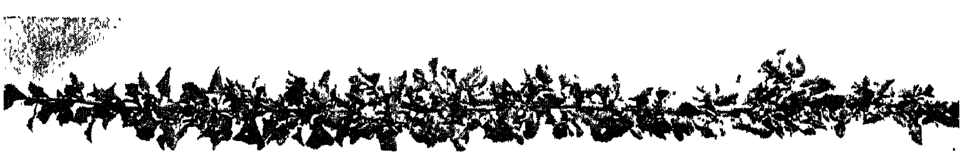
they were intended. It would have been unfair to have picked out one of these ploughs as superior to the others. I consulted the President and Committee of Management, and recommended that the judging be carried out as I have often done in connection with International Exhibitions, viz., to give a first award to all implements which come up to a high standard of excellence, as to construction, workmanship, and the purposes for which it was made. I obtained authority to award as many first-prize certificates as I considered were worthy. This I carried out with regard to ploughs of all kinds, reapers and binders, strippers, winnowers, harrows, seed drills and fertilizers, cultivators, &c. Of course the prize awarded was only a first-class certificate, but it gave complete satisfaction to all concerned; indeed there is no other way of doing justice to a large collection of high-class machinery.

Mr. Samuels, of Dubbo, one of my old students, took second prize with his collection of farm produce, and came close up to Mr. Gaden, who took the first prize with a splendid collection. Dubbo is considerably drier than Wellington, and Mr. Samuels is showing the people what can be done by deep cultivation and thorough pulverization of the soil. A very neat exhibition of agricultural produce, &c., was displayed at both the above-mentioned shows, from the Bathurst Experimental farm, in charge of Students Crowdace and Pollman; and they deserve great credit for the manner in which they displayed their produce and explained the methods of production, &c. I lectured at Dubbo on the first night of the show in the Town Hall, the Mayor in the chair. The place was crowded and I had a splendid reception. I also lectured at Trangie, Narromine, Peak Hill, Wilga Vale, Alectown, Trundle, Tichborne, and Bogan Gate. I was well received everywhere, and the people seemed very grateful for the information supplied on all topics affecting profitable methods of agriculture.

The Drought, its Effects and Lessons.

Stock are not suffering to any great extent from the drought about Wellington, Dubbo, or even at Narromine, but at Trundle, Parkes, and in the Bogan and Lachlan districts generally sheep are suffering from want of food and in some cases water also. Wheat, oats, maize, wheaten chaff, chopped straw, and molasses are all being tried in order to save the lives of the poor unfortunate animals, and there is a great diversity of opinion among pastoralists as to the most economical food to use. Train loads of fodder are arriving daily and being conveyed to the various stations in immense waggon loads to feed the starving sheep. It is indeed pitiful to see the poor creatures, in many instances only skin and bones and a little wool, just able to crawl; all the best edible shrubs have long ago been consumed, and stock-owners are now falling back on pine or box shrubs to save their sheep, which will eat even this in extremity. One great mistake often made by stock-owners is that they do not commence to feed their stock until they are too weak; and it is to be feared that that a large number of sheep will succumb when rain comes. While every consideration and sympathy





should be extended to the stock-owner in his terrible plight, still in many instances he has himself to blame. In good years the land is stocked up its fullest carrying capacity and every blade of grass usually devoured immediately it appears. There is no reserve in the shape of saved paddocks, edible scrubs, saltbush, hay straw, or ensilage, indeed most of the straw is burned after the stripping machine; yet, if mixed with a little molasses it is of great value in feeding sheep. One case came under my notice where a stock-owner grew 2,000 acres of wheat on the halves principle, and the straw was carefully stacked. It was afterwards cut into chaff and fed to the sheep; over 40,000 were fed on this for thirteen weeks, and all did remarkably well.

Though rain threatened during my stay, the indications passed away without giving any relief, and the condition of the stock-owners is as serious as it is possible to be.

The pernicious practice of overstocking in good years has much to do with the present sad state of affairs. The grass, as a rule, is never allowed to shed its seeds. Most of the indigenous grasses are annuals, and if they are not allowed to seed and reproduce they must disappear from our pastures; as a matter of fact they are doing so.

More subdivision, providing for paddocks to have an occasional spell, so as to give the grass a chance to seed, is one of the essentials in connection with successful grazing. Our pastoralists have received a lesson by which it is hoped they will benefit in future years; seasons of scarcity and want must be provided for. There is no lack of enterprise and pluck in connection with agricultural operations, even in the face of another apparently dry season. Very large areas of wheat are being put in; some of the crops have appeared above ground and are looking nice and green, while others have come up and withered away, but they will come again if rain falls.

List of Expert Judges for Agricultural Shows.

The Minister for Agriculture (Hon. J. Cook) has appointed a committee, comprising Messrs. J. L. Thompson, Allen O'Callaghan, Webster, Van Weenen, and Harold, to compile a list of expert judges for horses, cattle, sheep, pigs, poultry, dogs, farm, and dairy produce, to act at all Agricultural Shows throughout the Colony. The first meeting of the committee will be held at the rooms of the Board for Exports, 40, Young-street, on Monday, the 3rd of July, at 2 p.m., and it is to be hoped a full list of expert judges will appear in the August number of the *Gazette*, so as to enable societies to make a selection for their spring shows.

Planting out Saltbush.

INQUIRIES have been made for information as to the best means of propagating saltbush. In another part of this issue Mr. Peacock, Manager of Coolabah Experiment Farm, refers to the success attained in the conservation of saltbush by Messrs. Dickson Bros., at Yarrawin. Their method is to collect and distribute the seed throughout their run, and for this purpose over two tons of seed have been collected. The benefits derived from the system followed are described by Mr. Peacock.

At the Wagga Experiment Farm both seeds and cuttings of Old-man saltbush have been tried. The seeds were sown in beds, and the young plants transplanted when about 5 inches high in a large plot of well-worked sandy soil. They were put in drills 4 feet apart, the plants being 2 feet apart in the drills, and afterwards thinned out so as to leave the plants 4 ft. x 4 ft. This distance was found to be quite close enough, for the plants in a very short time were touching. At the same time another plot was sown broadcast, and the seed raked in. A good percentage of plants came up, but owing to the slow germination of saltbush seed and the risk of the seedlings being choked by weeds, the plan cannot be recommended. Propagation by means of cuttings was very successful. Medium-sized wood, about 12 to 15 inches in length, was used. The cuttings were planted in drills the same distance apart as the young plants, *i.e.*, 4 ft. x 2 ft., and every other plant removed when they had made a fair growth. They were put in 6 to 8 inches deep, and the soil was then pressed lightly round them.

In the opinion of Mr. Valder if this system is adopted in showery weather in autumn, large areas can be successfully planted out. From twenty-five to thirty plants, twelve months old, will provide sufficient cuttings to plant an acre.

In the accompanying illustrations some cuttings as used at Wagga are shown. The thicker ones are considered to be the best for setting out, though where the land has been well prepared and there is sufficient rain any of them will speedily produce plants as shown in the view of the saltbush plantation at Wagga.

In October, 1897, Mr. John Duff had an article in the *Agricultural Gazette*, in which he advocated the enclosing and ploughing of strips along the sides of paddocks to be planted out with Old-man saltbush slips to maintain a supply of this fodder for lopping in dry seasons.

The idea should not be difficult to carry out provided a small nursery plantation be established to provide ample supplies of cuttings for the reserve plantations.

Full particulars with respect to varieties suitable for cultivation and a report on their fodder value will be found in the *Farmers' and Fruit-growers' Guide*, pp. 202—208.

SALTBUSH CUTTINGS (natural size) AS USED AT WAGGA FARM.

Poultry Houses and Runs.

J. J. McCUE.

I AM often asked, "What is a good style or plan for a practical poultry-house?". Now this is a very difficult thing to do, because some poultry-keepers wish for a very ornamental structure, while others, whose means are smaller, wish for buildings that are severely practical, or up to what a poultry-house should be. Some poultry-breeders have plenty of room, and could do with portable houses, so that they could shift them from place to place. Others, with limited room, require a different house, and would like to know how many fowls they can run on that area to get proper results.

The shape and size of a poultry-house generally depends on local conditions and circumstances, so that it is hardly possible to speak of that which will suit all persons. If the poultry-keeper is a land-owner, or has a good lease, the cheapest and best house to go in for is timber walls, and bark, ruberoid, or shingle roofing; galvanised iron is used very much for covering poultry-houses, but it is not as good as any of the above for comfort, as it is a rapid conductor of heat and cold. Whatever roofing the poultry-keeper should use, let it be perfectly rain-proof.

Another important point about a poultry-house is the floor. If this be not properly made, no matter how well done the rest of the house is, it cannot be right, for a damp floor means a damp house, the result being no eggs, plenty of ailments and disease. The floor should be raised fully 10 or 12 inches above the yard or ground outside. A good plan, when the house is erected, is to fill the space inside with broken stones, bricks, or cinders to the depth of 6 or 7 inches, then 3 or 4 inches of some good stiff clay on top, well rammed down, and kept well sanded on top—of course, cement or asphalt makes a neater and better job and costs a neater and a better price—still, the earth-floor, if properly made, will answer just as well. There is also another consideration, if the house-floor be not capable of being kept dry and sweet the atmosphere of the house can never be healthy; in time the floor becomes saturated with ammonia from the droppings, and this impregnates the air, day and night. Always remember—"A dry floor and cleanliness in the poultry-house save many from the dreaded poultry diseases."

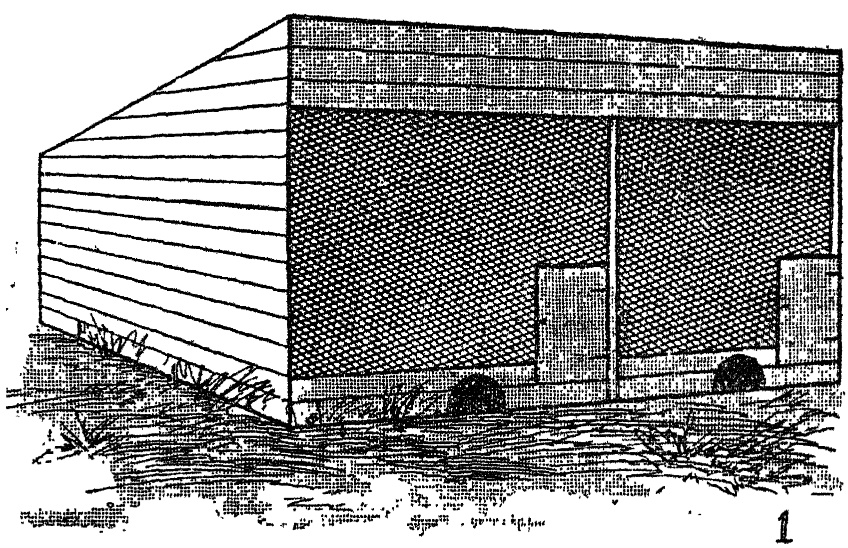
In building a poultry-house, I would advise my readers to consider the convenience and comfort within, more so than outside ornamentation. The house that is snug, roomy, and convenient, perfectly dry, and amply lighted and ventilated, is the model fowl-house, be the architecture what it may. Such a house is practical, and in such a house good returns are the rule—all other things being equal.

The roosts in the house should not be one over the other, all should be on the same level, and about 2 feet from the floor. If underneath the roosts a platform is built the droopings of the night will be caught.

Another thing to be remembered—"Never have nests in the fowl-house." All nest-boxes should be portable, and placed behind, or on a sheltered side of the house. When lice once infest a house the nest-boxes become their principal hiding-places, and if these nest-boxes are fixtures or fastened to the building, it becomes a difficult matter to fight the lice.

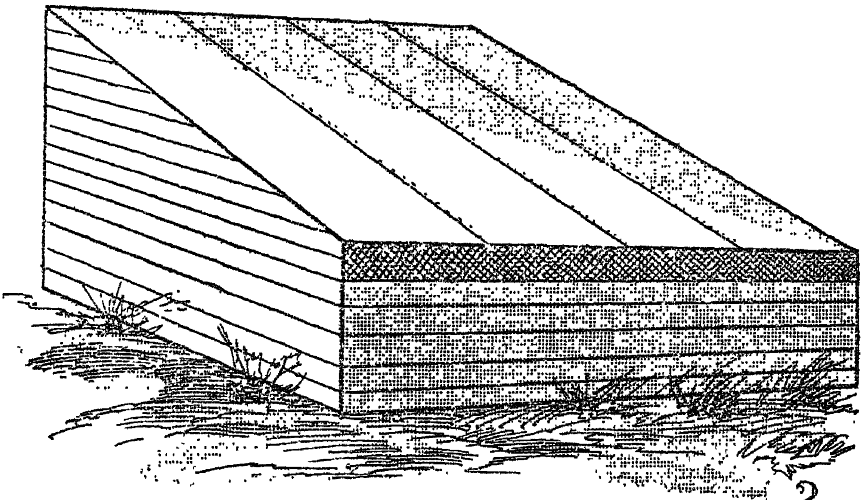
The size of the house, of course, will depend on the number of fowls that the owner intends to keep. As a general rule, for a cock and six hens of the larger breeds, 6 or 7 feet square is ample; for the smaller breeds a little less would do.

In all poultry-houses it is necessary to have one large door for the use of the owner or attendant, and a small trap-door for the fowls. The position of both these will depend greatly on how the house is situated. It is best to have the door where the inmates will not be unduly exposed to cold or draught, for, if put on the windy or cold side of the house, it will be hardly possible to keep the fowls comfortable. For example, in some districts the west or north-east winds are most troublesome, and it is nearly impossible to maintain the comfort of the fowls if the door-way faces these troublesome winds. It is a good plan to have an open weather-shed or scratching-shed built, adjoining and covering or protecting the door-way.



1

The house illustrated and marked No. 1 is a double house, and can be so built that half will be in one pen and the other half in another pen; building in this manner saves material and labour. The size, of course, will depend on the number of the fowls the owner wishes to accommodate; for a breeding pen of (say) a cock and eight hens, 12 ft. x 6 ft. would be large enough.



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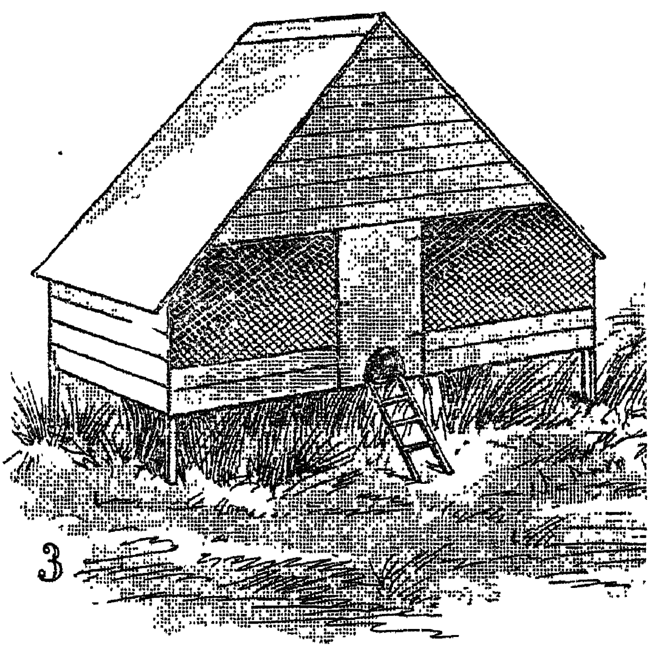
No. 2 is the back of No. 1, showing the wire netting to allow of ventilation near the roof.



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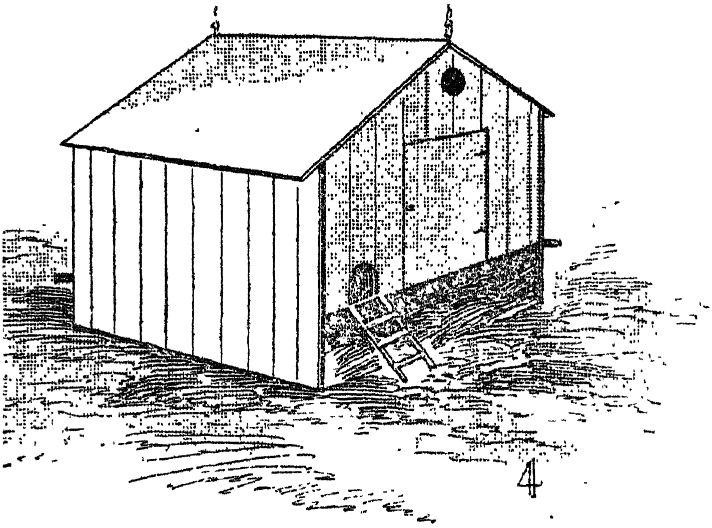
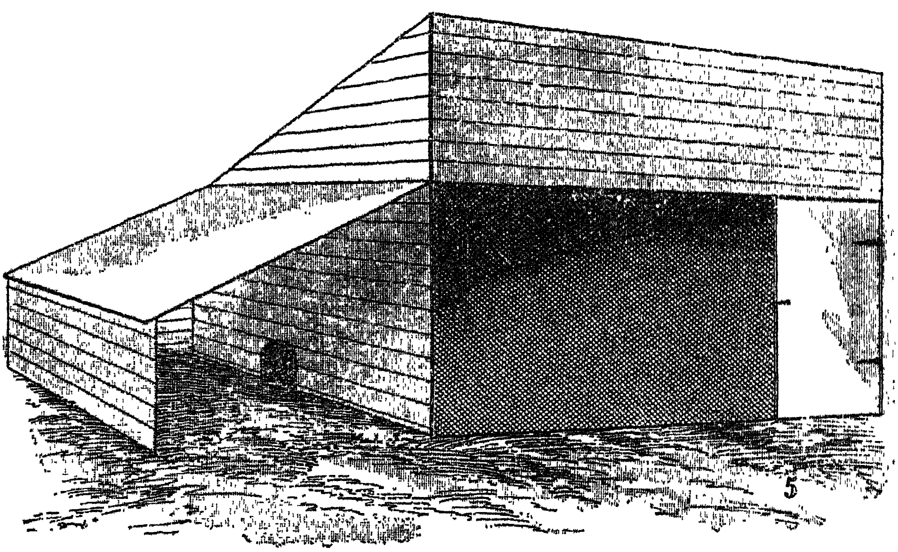
No. 3 is a handy, movable house, 9 ft. x 6 ft.; and will be found very useful where the poultry-keeper wishes to move his fowl-house to new ground.



4

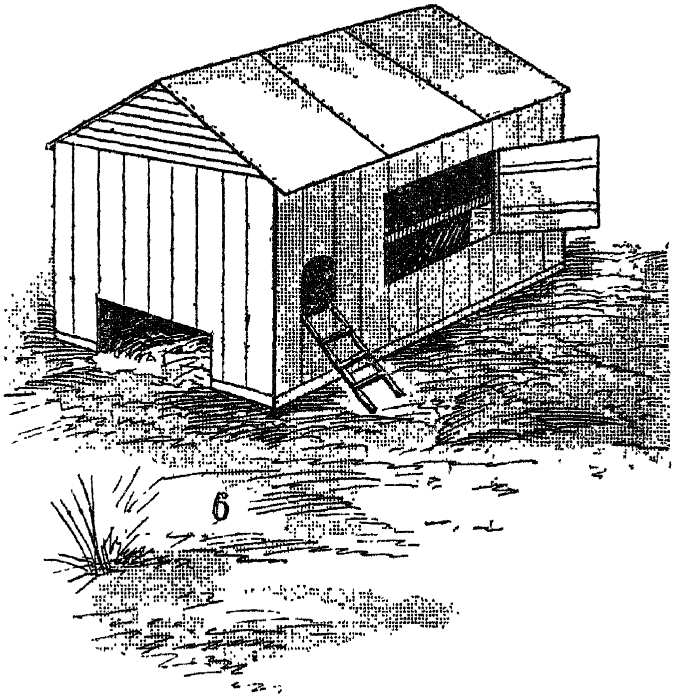
No. 4 is another portable house, 9 ft. x 6 ft.; it is a cosier house than No. 3, the walls being down to the ground on the two sides and back. Two battens can be nailed on the walls under the floor, and allowed to project 8 or 12 inches for hand-holds to move the house.



5

No. 5 is a house and scratching-shed. If the owner wishes he could place the door in the end of the house under the shed, and board up half the front. This would be advisable in very cold or exposed sites, but in a warm or fair climate the house shown would answer.

No. 6 can be built small, or large, and can be recommended for damp sites, or where the owner is compelled to build on sites from which the rainfall does not get away quickly. It is floored 2 feet from the ground and has a large window entrance instead of a door—of course, a door could be made instead of the large window.



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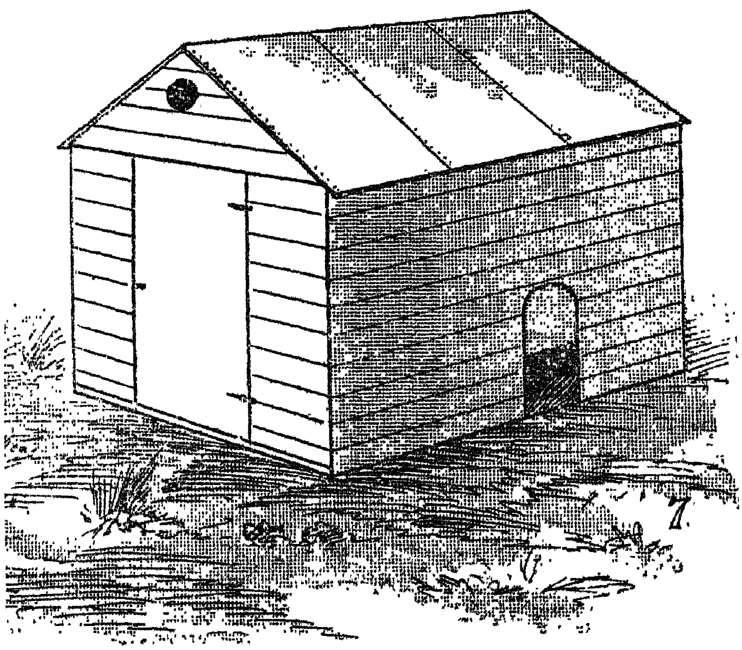
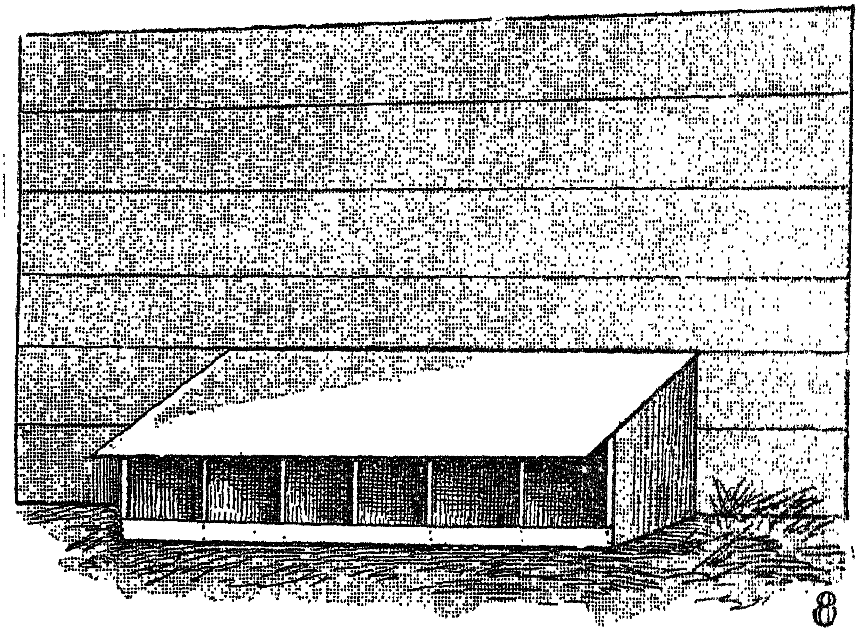


7.

No. 7 is another snug house, suitable for a cold, bleak climate, and can be built to hold a dozen or fifty fowls; if for a dozen, it could be made portable.

No. 8, portable nest-boxes. These can be placed by the side of the wall of the house—at the back, or wherever most convenient to get at. A nice size for each nest would be about 10 inches wide and 14 inches deep.



8

The material for building the houses will depend on the owner's purse, but there is no need for costly timber, nor would it be good policy to use an inferior timber that would have to be replaced in a year or two; build substantially, and you will find the first cost the best.

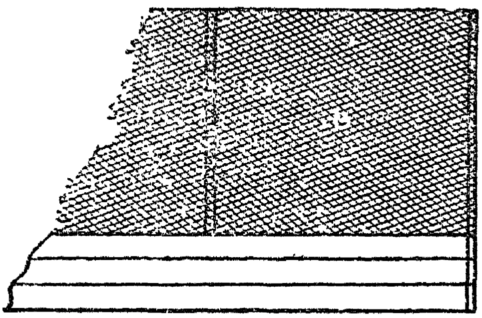
Never try to crowd twenty hens into a house where there is only room for ten. Ten feet by 10 ft. is about ample room for ten fowls to have them do well—some may think this area rather large for ten fowls; a little less will do. Overcrowding leads to vice, disease, and failure. Feather-eating, egg-eating, over-fat, egg-bound, and no eggs at all, are all traceable more or less to over-crowded quarters.

Cleanliness in the house means "everything." The houses should be thoroughly cleaned at least once a week—daily, of course, would be better; the houses lime-washed thoroughly every spring; a little carbolic acid mixed in the wash is death to all lice, and acts as a disinfectant—keeping your poultry-house nice and clean means perfect health for your fowls, and a bigger profit from them at the end of the year. Just as in everything else, the man or woman who loves the business, furnishes good comfortable quarters, sees that the houses and yards are kept clean, and exercises judgment in the sales and purchases, can make poultry-keeping profitable.

The pens, or runs, if possible, should be grass plots; but, of course, many may not be able to provide such; in that case they will have to

supply the grass (green food) by feeding their fowls with lettuce, cabbage leaves, &c. But for real comfort and less care, nothing can beat a good, clean grass run. As to space absolutely necessary to keep fowls in good health, nearly all poultry-keepers agree that it requires at least 10 square feet of run for each bird of moderate size, and about half as much again for the larger breeds.

The best material for enclosing a run or yard is wire-netting (I like 2-inch mesh best) 3 feet wide and 3-feet palings at bottom—or 4-feet wire-netting and 2-feet palings—or boards nailed longitudinally from post to post. See illustrations Nos. 9 and 10. The posts for the



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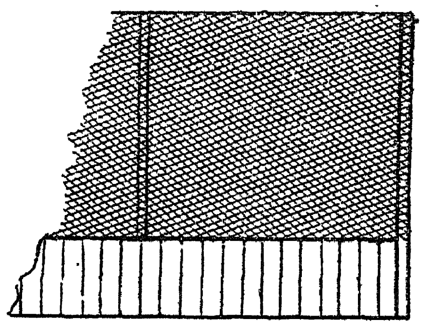

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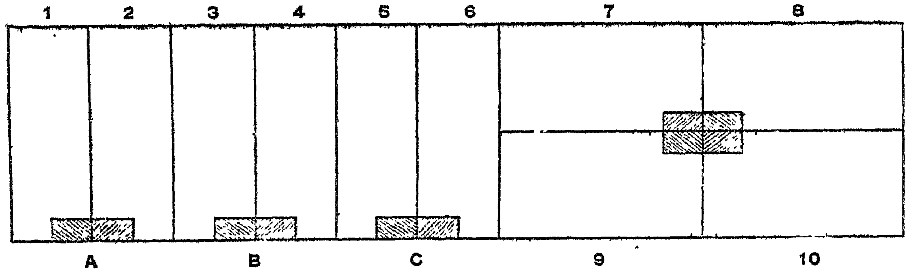
fence to be about 8 feet long, and not less than 4 in. x 4 in., if square, and 6 inches or 8 inches in diameter if in the round. If the posts are not placed more than 9 or 10 feet apart the netting will keep in better order and look neater, besides lasting longer.

In putting on the wire-netting always hang it nice and tight along the top of the posts, then draw it down tight on to each post, then put up your palings or boards, and start nailing the wire-netting down at the middle, between each post, then nail towards each post, and you will get the wire-netting tight and neat every way.

The site chosen for the yard or run should, if possible, be a nice dry one; if it be a damp, cold clay, or one that takes a long while to dry after rains, it should be drained; many sites may be benefited by draining; often an open drain on the high side will do a great deal of good. Anyhow, the owner, if he has the least bit of brains, will see, and be able, after the wet weather, to improve his run, either by draining or filling in all uneven surfaces that hold water.

A good plan, where the owner has the room, is to make two medium-sized yards out of one fairly large yard, and run the fowls in one while the other has a rest; in this way you get more out of the space than if you allowed the fowls to run over the lot. It is wonderful how quickly a run that has been eaten down short will recover and produce nice green grass if the weather is at all favourable. Of course, the droppings from the fowls account for it, and these droppings soon disappear and become used up by the grass and weather, which leaves the run in perfect order for use again.

Small runs or pens are of little value—no more than large ones—if they are overstocked, the owner should never stock so close, that the fowls will get ahead of the grass, and keep it bare. As I have said: "If you have not the room, then you cannot expect grass runs, so must supply the green food."



The breeding runs marked 1, 2, 3, 4, 5, and 6 are each 50 by 20 feet, and will each accommodate thirty to fifty fowls, and the houses marked A, B, and C are built double—half in each pen, and if the owner chooses he can build double scratching-sheds, after the same manner as the houses.

The four large runs, 7, 8, 9, and 10, each 100 feet by 25 feet, are suitable for cockerel, pullet, and laying-hens. The other run can be left as a spare pen, so that the owner will always have one run resting. By moving, say the pullets, into the spare run when it is in good order, their run can rest; when it is in good order the cockerels can be moved into it, and their run allowed a rest, and so on with the laying hens. Each of these pens will run from thirty to fifty head of fowls, which is about the greatest number of fowls that should be run together.

The house accommodation for these runs is one large building divided into four divisions, giving a house in each pen. The building should be at least 24 feet long and 12 feet wide; this will give a room of 12 by 6 to each. If built this small, cleanliness in the building will have to be attended to at least three times a week, for where such a number roosts are so close, the droppings will be plentiful.

Before I close this paper, I wish to impress on my readers the necessity for cleanliness in the houses and runs. Neglect this, then disease and failure will follow, as sure as night follows day. Keep everything nice and clean, and your fowls and place will be a credit to you, a pleasure to visitors, and a pleasure and profit to yourself.

There is no profit or pleasure to be gained from fowls that are compelled to roost in the pig-sty, or on fences or trees. You should give them shelter—house properly, and get proper returns; you will find they will pay for the expense of house comfort.

Most farmers are under the impression that if their fowls have not full run of the farm they will not thrive or pay. It is not acreage the fowls want; it is quality of soil, properly housing, feeding, and judicious penning of numbers. The farmer that runs more than fifty in one flock cannot get proper returns or profits, as he would if he ran them in flocks of fifty and under. On very few farms do we find the fowls nicely penned, or do we often find the proper class of fowl for profit on the farm. Most of the hens are as old as Johnny or Mary

(seven or nine years respectively), the two eldest of the family. Hens of such an age have forgotton years ago to lay sufficient eggs to pay for their "tucker." The farmer should keep good healthy birds of a laying or general utility breed, feed them well on proper food, house them properly, keep their quarters clean, and if the owner has selected correctly for what he intends to produce, then he cannot but be successful. Another thing let him not be disappointed on his first year's returns, if the fowls have not turned out as he expected. Always remember that few, very few, of us can be successful in our first year's trial at poultry-keeping. The first year should be a sort of apprenticeship, and the beginner should not expect big profits all at once,, or "count his chickens before they are hatched"; for, as time passes, he will find out many little things forgotten or neglected in his first year's attempt to produce big results. And so, season after season he will improve in his care and management, and often look back with a grin at how he ran his poultry farm the first year, and expected big profits.

The Export of Poultry.

The poultry shipped from Sydney under the auspices of the Board for Exports during the season which has just closed appear to have created a very favourable impression. The reports coming to hand are of the most satisfactory character, and show that, if the quality can be kept up in future shipments, we have an almost unlimited market for this class of produce. In reporting on shipments which left here in February and March, one of the largest London merchants makes the following comments :—"The 'Warrigal' and 'Nineveh' shipments to hand are excellent in every way. Special praise must be given to the chickens. We could easily dispose of 500 cases (10,000 head) weekly from February to June. The ducklings are also very good. If I had them early, like the first lot, they would have made quite 8s. per pair. These, however, fetched 6s. per pair, as also did the chickens. The chickens from New South Wales are far superior to the Canadian, Russian, Austrian, or any other chickens that are coming from abroad.'" The poultry referred to were chickens of 15 to 18 weeks' old, principally of the Orpington and Game-Orpington type, while the ducklings were chiefly Aylesbury, and about 9 to 11 weeks' old. One shipper, who sent 400 ducklings in a previous shipment, reports that he made from £30 to £36 more profit on that small quantity, after paying all expenses, than he would have had he sold them locally. Farmers and others who may wish to try raising poultry for export during the coming season should begin making arrangements at once, as those ready for shipping in December and January are likely to command the highest prices. The London merchants have their own agents in Sydney, who are prepared to make liberal advances on all consignments graded and packed at the Government Export Depôt, Darling Harbour. These agents also undertake the shipping, payment of freight, &c., so that all the grower has to do is to have the right sort of birds properly grown and fed, and despatch them to the depôt.

The Popular Orpington.

(Continued from page 401.)

GEO. BRADSHAW.

English Opinions of Orpingtons.

I HAVE already said and shown that the fanciers in England received the new breed with anything but enthusiasm. Mr. Cook was not a fancier in the general acceptation of the term; neither was he an exhibitor, and any poultry production emanating from any source but these was regarded with suspicion; hence when the single-comb, clean-legged, black fowl was spoken or written of as a "new breed" the matter was pooh-poohed, one contributor to the papers at that time going so far as to describe them as an imposition, and now at the close of a thirteen years' existence, and at the height of popularity, these same fanciers are wondering at themselves for their then opposition, and this opposition can be rightly wondered at, seeing that but a few years before the English fanciers received with open arms from America first Leghorns, then Rocks and Wyandottes, and although the two latter breeds were justly spoken of "as the best all-round fowls," still, for commercial purposes in England, both had the handicap of yellow legs with the too-frequent accompaniment of yellow skin, while the skin of the abused Orpington was as white as that of the much-favoured average Dorking. A recent writer on this subject of English home manufacture thus puts the matter: "It is from America that most of the new varieties of fowls come. American efforts in this direction have been by no means wanting in success. Witness the several sub-varieties of Leghorns, the now popular Plymouth Rock, and Wyandotte. An English fancier occasionally makes an effort to strike out in a new line, but whatever may have been the case some forty years ago, when the fancy was comparatively in its infancy, there is no doubt that now-a-days the attempts made to bring forward new breeds of home manufacture do not meet with much encouragement. From the point of view of the fancier, there is plenty of room for new varieties, especially in the utilitarian sense, provided they be distinct and sufficiently established not to betray the original elements from which they were manufactured. It is probably on account of the premature way in which the results of English attempts to form new breeds have been brought forward that they have failed to attain anything like the success of imported specimens of manufacture. We have also a national prejudice in favour of being imposed upon, and just as we accept American bacon more readily when it is labelled "Best Limerick," and sold at a high figure, than when it is truly described and priced accordingly, so we much prefer to be told that

our new varieties of poultry are descended from birds imported from some unknown region, rather than learn the truth as to the elements from which they were formed."

In relation to the Orpington opposition the truth of the closing sentence of the above quotation will be apparent, and there is not a doubt but had the originator maintained an air of mystery in connection with the component parts of his new fowl its popularity would have been earlier assured. However, this opposition was little heeded by Cook; he continued on his course of poultry-breeding for profit, lecturing, and otherwise propagating the new poultry gospel, advocating improved methods in the industry, and pleading with his audiences and the public to give the new breed a trial; and as the majority of those who attended his lectures did so with the purpose of receiving instruction in the way of better paying results, and to that end were influenced in favour of the new breed, and of the many hundreds of letters published on the result of these trials in the early history of the Orpington, the vast majority was in laudatory terms of its superiority. These unsolicited testimonials from ordinary poultry-keepers to the merits of the new breed soon brought conviction to the fanciers that there was something in them after all, and as the fancier who goes in for a new variety in its early history usually makes the most money out of it, so it was with the Orpington; and as an occasional setting of eggs or trio of these birds from Cook got into a few fanciers' hands, there was soon application made to the societies for classes for the new production. Their appearance in competition for a year or two was confined to the variety class, but their rapid spread throughout the country amongst all classes of poultry-keepers, obliged the societies to make provision for this variety in their schedules, and they have now for several years become a recognised breed with agricultural and fanciers' societies alike.

A dozen years ago the first pair of these birds ever exhibited appeared in the "not-for-competition class" at Birmingham and the Palace Shows. Their representation at the last great Dairy Show, Islington, where only birds of the year are exhibited, was 30, 37, and 49, respectively, in three of the several classes provided; few varieties now approaching them in numbers in the English show-pens.

Black Orpingtons.

As mentioned in a previous chapter, single-comb black birds were the first to be known by the name of Orpingtons, and the character given them by the originator and testified to by thousands of breeders almost precluded the thought that any further inventions in the way of breeds or varieties would ever again come from that quarter. The birds were as near perfection as reason could expect, and were, as Mr. Cook said, able to withstand the hitherto ill effects of the show-pen. However, the originator, seeing the popularity which his birds were attaining in the exhibition world and the fancy prices which show-pen specimens realised in addition to his utility propaganda, became an exhibiting fancier as well, and once he entered upon this course it was no surprise to hear that other varieties of Orpingtons

were in course of manufacture. These have duly appeared and become widely known and distributed, and whether these later sorts or varieties will be superior to the originals is still a moot question; but one colour at least—buffs—are running the blacks hard for first place, and have become most popular with both fancier and utility men.

However, no sooner did prejudice against the original Orpington show signs of breaking down and the breed become a recognised one in the majority of exhibitions than a new Orpington appeared; and although I have insinuated that Cook's conversion to the fanciers' ranks was responsible for the new sorts and colours, still, in justice to the author, I will give his own apology at least for the Rose-comb Blacks, which was that some people objected to the single combs, they being so like Langshans; and to produce the Rose-comb Black variety he introduced a Rose-comb Langshan "Sport," and, in a few years, got this sort of a comb so fixed that they were as readily produced and bred as true as the others, and, except in combs, the birds are a counterpart of the first variety.

Relative to the expediency of producing this class of comb on an acknowledged utility fowl, the following may be of interest:—Some six years ago I was on a judging engagement in Melbourne which included Orpingtons, and for which Rose-combs had provision. Mr. James Pemell, of Randwick, one of this Colony's most experienced breeders of all classes of poultry, introduced to me the subject of Orpingtons, giving them a most flattering character for economic purposes. "But," said he, "Mr. Bradshaw, Cook made a serious mistake when he brought out Rose-combs. His other variety had every desirable useful quality, but in this new variety breeders will be giving their attention to the production of perfection in comb, a most difficult thing to accomplish, and to the neglect of type and other utility qualities." I was in thorough accord with the Orpington breeder and advocate, and we have since then both been living witnesses of the struggling existence and almost extinction—at least in this Colony—of the then much-talked-of Rose-comb and the triumph of the first variety.

Three years ago, at the N.S.W. P. P. and D. Society's Show, Rose-combs had eight entries, which last year were reduced to a solitary exhibit—the single-comb variety each year increasing in popularity; still, in spite of the small attention given by breeders to Orpington No. 2, they possess the majority of the good qualities of their progenitors. Mr. Cook, writing of them in his poultry journal so late as last July, says—"One thing is especially noticeable, and that is that there is a great demand for Rose-comb Black Orpingtons, as there is nothing at present that is anything like them; as birds for the market their black legs are somewhat against them, although their flesh is as white as that of Dorkings, and the skin is as fine. Black Hamburgs have Rose-combs, but they are small birds; but Black Rose-comb Orpingtons are big birds, and lay a heavy brown egg. This, of course, will be a well-known fact to many readers, particularly those who have reared Black Orpingtons, but we only give this as a fact which has in it something of an expla-

nation of the greater popularity of the rose-comb variety. Of course, black birds are much better for keeping in or near a town, as the plumage is not so likely to get soiled and show the dirt; and then again, people like winter layers and every other variety of the Orpingtons, as well as rose-combs, are good winter layers; and if people can get plenty of fine brown eggs during the autumn and winter months they are satisfied, and rose-comb Black Orpingtons will produce these in plenty. Some people are very anxious to know if all the birds come with rose-combs, and we are able to say that they do not, nor do any birds of rose-comb variety all breed rose-combs, and Wyandottes and other newer varieties throw a great number of single-combs; and so with Orpingtons, sometimes not one single-comb will come in twenty, at others six or seven will be produced. Orpingtons are right to the front in the colonies, and in Australia they have taken well. We are frequently encouraged by hearing of good success gained in Colonial show-pens by splendid specimens of these Black Orpingtons, many of which have come direct from our own yards, and we can quite understand that the keen colonists prize such birds highly and have taken them up in preference to any other breed. The cocks have been used very extensively for crossing with the farmers' fowls."

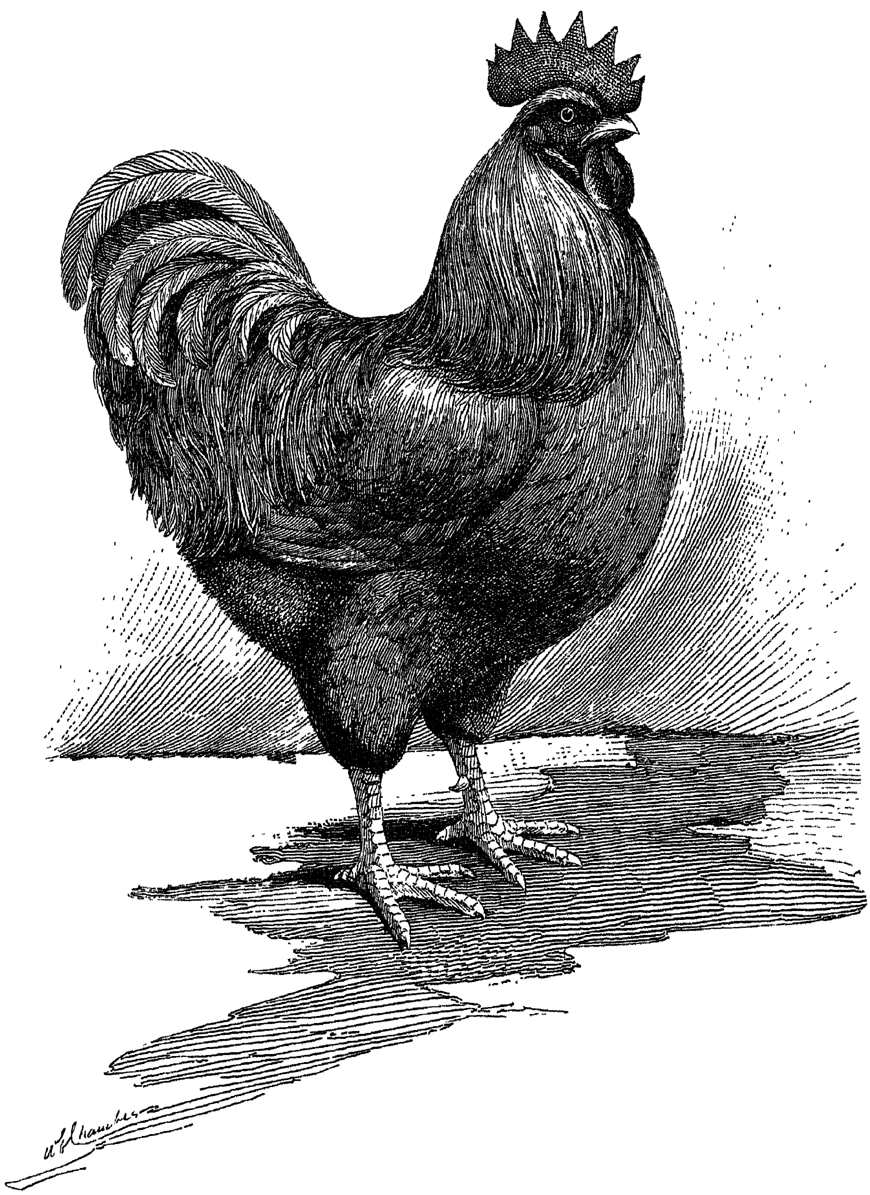
White Orpingtons.

The success of Cook's first and second experiments in fowl making, as can be readily imagined, prompted him to further efforts, which resulted in three years after the production of the Blacks, he, this time going to the other extreme in colour, the due arrival of White Orpingtons in 1889 fairly astonishing the poultry fraternity. The explanation or apology for the Whites is not very definite, but is embodied in the following:—"I proceeded to produce, as far as possible, an ideal set of breeds that would do great things for the poultry-keepers of the present and the future"; consequently, Whites are one of this set, and the method of their production is as follows, in Mr. Cook's own words:—"I had made many experiments to find out the best method of producing white fowls that were up to date. I began by crossing the White Leghorn cocks with Black Hamburg hens, and the pullets from this cross came every one white. I next used a rose-comb White Dorking cock, mated with the offspring from above, and some of the birds came blue, some barred like Cuckoo Dorkings, and it was a long time before I could produce white birds, and even now occasionally some will come with coloured feathers on them, and the Dorking is seen sometimes when a five-toed bird is produced; so with careful breeding, the white rose-combed Orpingtons were made into a breed which produces quick-growing vigorous birds, with good laying and table qualities; and, strange to say, although I have never pushed them forward, or put them into the show-pen, they have taken wonderfully, and poultry keepers have found them lay more than any other white breed. 245 and 250 eggs each a year some specimens have produced, and others have laid 190 eggs in the same time. They are splendid table birds, have white skin and legs, and this is a point with English people. Then

the single-comb White Orpington was produced by using a single-comb White Dorking in place of the rose-comb. There is the same difficulty with these birds as there is with all other white varieties—that is, although they do well in confined runs in town, the plumage shows the dirt and never looks bright. As layers they can hold their own with almost any other breed, the eggs being of a cream colour and of a good size. White Orpingtons lay about the same number of eggs as Leghorns the whole year through; but some of them are liable to throw dark feathers, while in others a few brown ones will sometimes crop up, but this is now rare. The chickens grow remarkably fast, and feather as quickly as young partridges. The cockerels can be killed at an early age and their skin is as white as that of a Dorking, and the legs the same color; the pullets will lay at five months old, but most of them are in full lay at six and a half months old. The following are the points to be sought after in selecting good specimens of this variety :—Neat comb, white beak, red face, white plumage throughout, white legs, and four toes on each foot; the cocks should carry their tails fairly well back, much the same as a Dorking. The cocks are splendid for crossing with White Leghorns, Light Brahmas, or White Dorkings—that is, if the owner wishes to keep his stock birds white and yet does not at the same time wish the laying qualities to go down. It must be understood that new breeds are usually excellent layers. We do not remember hearing of a single complaint of bad laying results from the White Orpingtons; and this is most encouraging, as we have aimed at producing birds of utility rather than a fancy breed, which in the future will indeed be the leading feature of all breeds which are preserved to posterity. Leghorns have, of course, been looked upon as the best layers for a great number of years, but Orpingtons have come in and taken their place very largely, and in the future are likely to do increasingly, as the White Orpingtons have surpassed them generally, because, whilst possessing splendid laying results, they are also excellent table birds as well. This, of course, makes the Orpingtons more valuable. The great difficulty in connection with the small breeds like Leghorns consists in the fact that there is always a large number of cocks to be sold or killed for table. These being small birds, of course realise less than the White Orpingtons, which are good layers, and as fine table birds as they are layers. Then, again, this rule holds good where crosses are kept, for the cross-breds are finer and just as prolific layers as well." So far as White Orpingtons in the Colony are concerned, they have made but very little headway. Occasionally an individual specimen has been seen in the show pen, but the prospect of them ever becoming favourites in Australia is very remote indeed, other easier kept colours meeting every requirement of the fancier and the breeder for profit.

Buff Orpingtons.

Now nearly two years ago, when writing in the *Gazette*, on "Profitable Poultry Keeping," I mentioned that fashion had a lot to do with the popularity of varieties or breeds of poultry. For a number



BUFF ORPINGTON.

of years one breed will take the public taste, then another will be in the ascendancy, following this a resuscitated old breed may displace all the former; and then a particular colour of one or all the breeds will have a call, and be boomed for all its worth. In the article in question I mentioned that the buff colour was then the fashionable one, and whatever it was then it is now ten times more so. We have now Buff Rocks, Buff Leghorns, Buff Langshans, Buff Wyandottes, and even Buff Bantams. This buff rage first became pronounced some six or seven years ago, and Mr. Cook was business man enough to take "the tide at its flood," by meeting the public clamour for a buff fowl, and sure enough it "led on to fortune." The Black Orpingtons had been exactly nine years before the public when the buffs were put on the market. The first pair ever shown was at the Dairy Show, 1894, and in the space of nine months after their appearance, the originator had sold 400 sittings of eggs from the new variety, and in the first year disposed of over 200 stock birds for breeding purposes; and writing in 1895 of his then very latest production, Mr. Cook said:—"No variety of fowls up to the time blacks were brought out ever took so well in England as they did, but the buffs have sold off quicker in the time than even the blacks. Some people may say, Why bring out the buffs when the blacks do so well,—is it not overdoing it? Not in the least. No one ever complains of a florist bringing out new flowers, particularly if the colour is more attractive than that of the old varieties; so it is with Buff Orpingtons. In introducing the black and white varieties, I told the people how they were made, and I will do the same with the buffs. First I mated a Golden-spangled Hamburg cock with a coloured Dorking hen of good size, and from the best laying strain obtainable; these produced pullets of a reddish-brown colour, which I mated with a Buff Cochin cock. Hamburgs are excellent layers, but rather delicate to rear as chickens. The Dorking is a splendid table bird, with a very long breast, and when crossed with the Hamburg will produce wonderful layers. Buff Cochins become very broody, and have a great deal of leg feathering. When bred from a good laying strain they make good winter layers. When mated with a Hamburg and Dorking cross, they produce quick-growing birds with splendid laying and table qualities. The chickens are so hardy that they can be reared in the coldest frosty weather. As already said, buffs were brought out in 1894, the originator anticipating such a demand that in 1895 1,000 chickens of this variety were reared at Orpington House, the craze for them being such that long before the close of the year every bird for sale was disposed of, the majority of them being dispersed throughout England, but large numbers of them also going to South Africa, Canada, United States, New Zealand, and Australia; while in the early months of 1896, foreign orders to the extent of a thousand pounds were received.

This extraordinary demand I have attributed to a craze, for the simple reason that the time this variety had been before the public was insufficient to warrant any definite statement as to their merits. However, even at that early date, letters testifying to the excellencies

of the breed began to pour in to their author, many of which were published in his journal, and all affirmatory of their superiority. The following are a few of those received at the latter end of 1895 :—

"DEAR SIR,—I am so thoroughly pleased with the pair of Buff Orpingtons I had from you in the spring, and the splendid lot of chickens that I have, that I want to tell you of them. I have disposed of some of them, and have between seventy and eighty chickens yet. They are most wonderful layers, and very few mismarked ones amongst them.—Yours truly, Mrs. S. BROWNE."

"DEAR SIR,—I know you will be pleased to hear the result of the sitting of buff eggs I had from you in April. I had twelve chickens, and have reared ten most excellent birds. I shall do away with all my others, and keep nothing but Buff Orpingtons. They are good, both in size and plumage. Although two have some feathers on their legs, I am delighted with them.—Yours, etc., T. M. POPE."

"DEAR SIR,—The Buff Orpingtons I had from you have given me much satisfaction. They are splendid layers. I had thirty-two eggs in thirty-five days from one hen.—Yours truly, J. GOULD."

"DEAR SIR,—I am glad to inform you that the Buff Orpingtons I had from you have done well. As for laying, I think they cannot be surpassed. I have been breeding from four different varieties this year, but I find the Buff Orpingtons are hardier and easier to rear than any of the others.—Yours truly, B. MATTOSON."

"DEAR SIR,—I may say that for laying and table purposes combined the Buff Orpingtons leave nothing to be desired, as I have had pullets lay at 4 months and 6 days old, and cockerels that weighed 7 lb. under 6 months old without any special feeding. The colour also is very good. The only fault I find is in the leg feathers, but I think a year or two will breed this out. They are as hardy as any I have ever bred, being very free from any disease.—Yours truly, J. GREGORY."

I have reproduced the above testimonials only to show how quickly opinions are betimes formed on the merits of fowls, for, although all the testimony in the breed's favour has since been overwhelmingly confirmed, I must repeat that the most experienced breeder would hesitate to give confirmation on the merits of any breed with but twelve months' experience of them. However, as time went on, testimonials increased, and by the end of 1896 they were overtaking the Blacks for popularity. The extraordinary rush on or for this new variety being even a surprise to Mr. Cook himself, who, in attempting to explain such, said, "One reason why Buff Orpingtons have taken so well this past season is because of their quick growth. This got talked about, and was an inducement to many people to go in for eggs who would otherwise not have done so. Buff Orpingtons, besides being good layers, are excellent table birds, and, although they do not all come true to colour for exhibition purposes, they can be sent to the London markets or utilised for one's own table. Another reason why so many took to them was because they were so good winter layers.

Some twelve months after the introduction of the Buffs the editor of a progressive London paper, *The Cable*, went down to St. Mary Cray, on a visit to the Cook establishment, and early in his interview the new colour came under notice. "Yes," said Mr. Cook, "I have some Black Orpingtons brought up with Buffs hatched under the same hens, and reared under the same conditions, and in every case the Buff chickens were the largest of the brood, all having feathered quicker and grown larger than the Blacks." I don't mean to say that the Buffs always beat the Blacks, but in severe weather they invariably

did. When people arrived at the big shows the first question asked was, where are those wonderful Orpingtons that are so much written about? and when they saw what grand-shaped birds they were—short on the legs and broad in the breast—they at once decided to go in for them. Of course, I know that Buffs yet are not equal to the Blacks in size, but many of those who want good table fowls prefer the Buffs on account of the whiteness of their legs, and for show birds longer prices have been offered than were ever offered for the Blacks. Concerning Buff Orpingtons as a table fowl, Mr. Cook, in his *Fowls for the Times*, says, "There have always been difficulties with regard to market fowls of certain breeds that have yellow skin and black or coloured legs. White skin and legs are greatly preferred, and, consequently, the Black Minorca and Black Hamburg, good as they are for egg production, are not so profitable for table birds; and, of course, the Black Orpingtons, good laying and table birds as they are, fail in this respect; but when we come to the Buffs, the fine massive forms and white legs overcome every difficulty, and we get an ideal table bird which also possesses as fine laying properties. Buff Orpingtons are great favourites with the Lincolnshire hucksters because they have the white legs of the Dorkings, are fine massive birds, and, where they have been used for crossing, all have acknowledged that both the pure and cross-bred chickens are the best they ever had. Of course, for many years the Lincolnshire farmers have been content to go on breeding an old variety known as Lincolnshire Buffs, and these birds have done well on the bleak exposed farms and damp soil, so that they are justly popular with all classes of breeders in that county, because they have done well in places where other birds would have died; but when the fine Buff Orpingtons made their appearance the old prejudice in favour of Buff birds was met, and the pullets were laying six weeks before the Lincolnshire Buffs were producing eggs, and so averaged from thirty-five to fifty eggs per bird more than those of the famous old breed. This I proved to be the case when I examined the egg records in some of the Lincolnshire districts.

"In Sussex and Surrey the Buff Orpingtons are used very much for turning down in farmyards with mixed lots of fowls for improving the laying and table qualities, and these have done good service in this direction, and, where birds are not perfect specimens, are very useful for the purpose mentioned, and are used largely by poultry-keepers for improving their stock, as they can be bought at a low price and are as good as the best for that purpose. Farmers and others have done very well by using them as they have, because the pullets have laid before they were 6 months old, and gone on for a long time, so improving the laying and table qualities. The Game varieties have always been noted for table qualities, but the dark legs have never been so well got rid of as by the crosses with Buff Orpingtons, as these birds bring out all the best characteristics of the Game, and at the same time bring offspring with white legs and skin. This is a great consideration, as failings of this kind are better got rid of, and the Buff Orpingtons have opened up the way by which these objections

may be removed. The run of the markets indicates the tastes of the public, and when we read the high prices birds of a certain kind produce, it becomes apparent how salesmen and others who have to do with this branch of the business are anxious to meet with birds which will best answer their customers' requirements, and with Orpingtons the salesmen have always been delighted, the different varieties so well adapting themselves to market requirements as to fetch good prices. Of course, it is a greater pleasure for these men to sell good birds and also to please their customers, and it is not to be wondered at that they have hailed the advent of the Orpington breed with delight, and the farmers, too, find the better price just as acceptable. It must always be remembered that the farmer's profits depend largely upon the sort of birds he keeps, as bad birds eat largely and yield little return, so that birds that lay earlier, keep laying longer, and at the end are finer table birds, are, of course, the very best breed to keep for the purpose of profit and augmenting the income of the farm. In the past bad results have disgusted farmers, and led them to esteem lightly the advantages to be gained, and so it has been an arduous undertaking to convince these men that poultry may be made profitable, if only sufficient care is used in the management of breeding, and so as I look upon Orpingtons as one of the farmer's best hopes in the future, I am always glad when I am asked to look over the farmers' books and read the figures which tell of improved results and better profits."

Opposition to the Buffs.

In previous chapters I have shown the spleen exhibited against the Black Orpington in its early history, but as this had almost disappeared on the introduction of the Buffs it might be thought that fanciers, realising the ultimate triumph of the former variety, would pause before uplifting their voice against the latter; but this was not to be, all the old rancour was revived, while prominent breeders who had allowed the Blacks to come and conquer without resent, appeared in force against the latest innovation—the Buffs. This policy was rightly described by Cook as the violent and virulent opposition of the old-time enthusiasts who, dog in the manger like, would rather waste opportunities than let others, better capable of supplying birds for the times, carry on their benevolent work, and when the new breed appeared an outburst of nonsense hailed their introduction, until he had to meet arguments which were as foolish as they were spitefully ingenious, and as harmful as they were erroneous; how far they succeeded the popularity of all the varieties of Orpingtons to-day is a fitting reply.

Of late years in England when any breed of fowls has become at all plentiful among fanciers a club is usually formed to assist in developing it, by providing special prizes, securing competent judges, and otherwise framing regulations in the interests of the breed concerned. Black Orpingtons, like other varieties of fowls, had soon an organisation of this sort, formed by a few of its early admirers. For a long time the members were not a happy family, but, as the breed became

more general and breeders more plentiful, the membership increased, and the body generally became more useful in the Orpington interest. Relative to these clubs a well-known Victorian financier some time ago wrote, "Conducted with discretion they can be of much value, but when personal interests, private spleen, or dictatorial conduct of any kind is allowed to creep in, the usefulness is to be questioned," and so it was with the club formed to protect the interests of the Orpington, an annual meeting of which was held at the "Holborn Viaduct Hotel," London, on the 20th January, 1895, there being then eighty-four members on the roll. Buff Orpingtons had at that time been a year before the public, the recruits to this colour justly thinking that the club could much enlarge its usefulness in embodying the Buffs in its constitution; but such was not to be, the following paragraph appearing in their annual report, "The club view with strong disfavour the introduction during the past year of the so-called White and Buff Orpingtons, which are not allied to Orpingtons in any respect whatever," and before the meeting closed the following resolution, moved by the President, General Gillespie, was put and carried:—"That the club view with dissatisfaction the providing of classes by Show Committees for other than Black Orpingtons, and the club hereby refuse to grant medals or specials for any than the variety recognised by it." And, as showing the tyrannical nature of some of these clubs, a ten guinea special challenge cup was offered by the president and accepted, one condition of the competition being "that it was only open for competition to those who had never exhibited Orpingtons other than black."

The effect of this absurd attempt to make the Orpington fowls a close corporation for those who bred blacks only can best be gauged from the fact that, at the last great English Dairy Show, the buff varieties of Orpingtons, which had only been in existence for four years, completely overshadowed the blacks for both quality and numbers. The thirty buff cockerels were reported as being a magnificent lot, the buff pullets constituting an immense class of 49 exhibits, as against 37 blacks; and this in face of the fact that at that time the buffs had no club to look after their interests [A Buff Club is now established, 1899.—G.B.], attaining this position in spite of the embargo placed on them at the meeting at "Viaduct Hotel."

The resolution adopted by the meeting in question much affected Mr. Cook, who took umbrage at the club referring to the new variety as so-called Orpingtons, and in the following issue of his poultry journal gave his opinion on the attempted boycott. "As I am the originator of the Orpington fowl," he begins, "I think it only fair that I should be allowed to make a few remarks upon the report. When I bring out a breed of fowls, I always let the public know what blood is used to produce it. When some Americans bring out a new variety they give the best side of the birds, saying nothing about whether they breed true to colour or have any other failings; they leave the public to find that out for themselves.

"What first induced me to bring out Orpingtons was seeing the Americans bringing out new breeds or varieties, and the English

people taking them up, in many cases paying very large sums of money for good specimens. I could see no reason why some of that money should not be kept in England—in other words, go into the Englishman's pocket as well as the American's.

"I knew quite well we had many breeds in this country which could be blended together to produce a new variety as well as the Americans—in fact, we have better breeds to select from, for the Americans have never brought out a fowl equal to the Orpington—in appearance, winter laying, and table qualities combined. As I had been trying experiments for many years in crossing and re-crossing, I knew exactly what breeds to use to produce such birds, and I am pleased to say that my efforts have not been in vain. I do not say a word against any of the breeds the Americans have produced, but I do want to ask why we should pay such enormous prices that in many instances have been paid for birds to the Americans, when we can produce quite as good, if not better, ourselves.

"No one complains that we have too many varieties of flowers, yet we are constantly having fresh sorts introduced. As long as they are pleasing to the eye, and superior to the old ones, people admire them, and buy them at the same time.

"It is only a few old breeders who have not yet got quite out of the roads our grandfathers travelled in, and some others who are jealous of the success the Orpington has met with, that speak against these birds. I do not wish to boast of my success, but I am thankful people have taken the breed up in the way they have done. What I do write is what I know to be right, from practical experiments and keen observation. I never write an article from mere theory. The Orpington Club was formed a few weeks after Black Orpingtons were first introduced. Now, this club has helped the breed on a great deal. A few years after it was formed it partly collapsed, but was re-formed again, and has lately made great headway.

"Although I brought out these birds, I refused to take any office in the club, except an ordinary committee-man's place.

"At the general meeting I was unable to be present; but although I was lecturing in the north of Lincolnshire at the time the meeting was held, had I known in time, I should have put off my lecture, if possible, in order to have been there.

"White Orpingtons have been out now for six years, and have spread all through England without the help of the Orpington Club. Then, as to the Buffs, I should like to ask who is to prevent them being called Buff Orpingtons, if I choose to call them by that name? If I choose to bring out twenty new varieties, and call them all Orpingtons, no one has any power to prevent me doing so. I never asked the club to take up either the White or Buff. Had I done so, it would have been a different matter. Then again it says, 'That the club views with dissatisfaction the providing of classes by Show Committees for other than Black, 'Single,' and Rose-comb Orpingtons, and the club hereby refuses to grant medals or specials for other than the above-named varieties recognised by them.'

"I never asked the club to do this, but in spite of all they may say, I think there will be classes provided at Shows for the Buffs, and also specials. I shall not call upon the Orpington Club to take these birds up. There are plenty of people who will be pleased to recognise and also offer specials for them.

"Some may think I am not thankful to the club for the way in which they have helped the Black Orpingtons on; but I am. I have always worked with the committee. Though sometimes my views have been a little different to theirs, I have given way to the majority.

"I am very thankful indeed to all who have given time and money to make this breed so well known. No variety has spread so rapidly as the Black Orpingtons up to the present; but I believe the Buffs will, and I must say I do not think the club has any right to interfere with what I do outside the club. I thought it only right to put the report of the Orpington Club so that people might see both sides of the question."

With the above plain statement of facts in 1895, and the since unprecedented success of the variety as already noted, it would naturally be supposed all opposition would have ceased. It, however, did not, for during the past year another most acrimonious correspondence arose over the breed, the opposition this time going so far as to question the veracity of Mr. Cook as being responsible for the manufacture of the variety, they asserting that the breed is nothing else than an old buff fowl common in two or three English counties, and known as "Lincolnshire Buffs."

It may have been noticed that so far as these articles have gone there has been no evidence, or even suspicion, that the Buff Orpington was anything but that represented by Mr. Cook, or that he imposed on the public by substituting an every-day mongrel for an article of his own manufacture; still, at the expense of protracting this chapter, I feel obliged to reproduce a small portion of the voluminous correspondence, that readers may have the pith of both sides of this still-disputed question, particularly so, as Mr. Cook's opponents constitute a few of the best-known agriculturists, authors, artists, fanciers, &c. Mr. Lewis Wright, the well-known author of the standard work "Cassell's Book of Poultry," on this subject, during the past year, wrote:—"I am not such a stickler as our old friend Harrison Weir for what he calls purity of breed; on the contrary, I have for years urged the manufacture of new and useful varieties, nor would I question any man to give *his* breed any name he likes really open to him; but when a man has already appropriated the name of his residence to one such breed, of which he tells us the components were A, B, C, there are the gravest objections to his giving, years after, for merely trade and advertising purposes, the same name to another 'breed,' which, according to his own account, has no particle of A, B, or C, but was built up of X, Y, and Z. And the objection is accentuated when, as in this case, there is every reason to believe that the real origin of the breed was altogether different, and that it is really almost entirely composed of Lincolnshire Buffs—of a somewhat unformed but typical and useful fowl gradually evolved throughout a

wide district. In hackle, skin, colour, and delicacy of flesh they are totally undistinguishable from the Buff Orpington. The 'breed' is a most useful one, no doubt; but it is much to be wished it could even yet have a more honest name; but it is not legitimate to take a breed already made in the eastern countries, or which even if 'made' ten years ago in common with his already existing breed, and call them also 'Orpingtons.' The 'breed' should have a name of its own, anyhow, and the 'prejudice' some have been accused of has not been against a useful and attractive fowl, but on account of these circumstances."

Mr. Harrison Weir, the well known poultry author and artist, on the same subject, writes:—"I do not object to them as fowls, but as Orpingtons, I have said they so resemble fowls well known, that they are 'not new.' I have said it before, and I say it again, that years and years ago precisely such fowls were in existence. When the Buff Cochins came out, they were crossed with the old Kent and Sussex white-shanked red birds, a beautiful and useful class of birds being the result. There were hundreds of them in our southern farm-yards as long ago as 1855. I have seen them, handled them, and sketched them, and that even within the last few years. I admired them, and kept some for what they were—Lincolnshire Buffs; and when anyone calls fowls scarcely distinguishable from these, which I have known for forty years, a new breed, I entirely differ from them;—not for keeping them, but for what he or they call them. It is not in disparagement of the birds I write, but their title to such a name. The Black Orpington was said to be made at Orpington, and from the following breeds:—the Langshan, Rock, Minorca, and Black Hamburg. This combination then, I say, was allowed to be a breed, and that these components made an Orpington. Will anyone say that the so-called Buff Orpington has the blood of any of these breeds in its veins? Then, if not, by what order or right of things—blood, breed or what not—is it an Orpington? If it contained the blood of the different varieties that were said to make the Orpington, then it would be a Buff Orpington; but as it is, it is simply a buff fowl, but not a breed, neither is it new."

Mr. Edward Brown, F.L.S., Author of "Poultry-keeping as an Industry," Editor of the *Fancier's Gazette*, and Lecturer on Poultry, &c., wrote in the same strain as above confirming all the assertions relative to the similarity of the old local Lincolnshires and Cook's new breed. Numbers of people less known in the poultry world, but in more pronounced language, emphatically declared that Buff Orpingtons were but the old Lincolnshires resuscitated; on the other side Mr. Cook had supporters in abundance, all equally sure that the new Buffs and the old local breed were different in almost every particular which go to make a variety, but to bring this rather unpleasant development of the article to a close, the following letters must suffice. Mr. W. Richardson, Hon. Secretary to the lately formed Buff Orpington Club states:—"I have kept Buff Orpingtons since November, 1895, my first birds were a pen of seven from Mr. Cook. I reared about 300 chickens from them the first season, and only discovered one small

feather on one bird's shank. The next season I purchased a few birds for change of blood, but the chickens from these had feathers on their legs, and some of them yellow legs as well. I now know they were Lincolnshire Buffs, but they were sold to me for Buff Orpingtons. There is no doubt at all that Buff Orpingtons are a distinct breed from Lincolnshire Buffs, though one could find Lincolnshire Buffs very like Buff Orpingtons, especially where the old birds were mated with a Buff Orpington cock, and these are sold by unscrupulous persons as Buff Orpingtons. I have nothing to say either for or against Lincolnshire Buffs—in fact, I have always understood they were only a market fowl produced from ordinary farmyard fowls crossed with Buff Cochins."

Another correspondent writes:—"I think the best way to settle the matter is to call them Buff fowls and be done with it. Mr. Harrison Weir's letter is very good; he is not going to notice Buff Orpingtons in his new book, neither is Mr. Lewis Wright in his, which reminds me of what Mark Twain lately said, namely, the Czar of Russia was greatly in favour of general universal disarmament and so was he (Mark), so then there would be no difficulty about the rest of the world." The comparison is obvious.

Mr. Cook replied to his numerous detractors as follows:—We all remember Mr. Weir's opposition to the Blacks, when they were introduced he said that such mongrels would not take, but in this he was wrong, as the Black Orpington has spread all over the world, and classes are now provided in Australia and South Africa for Buffs as well as Blacks. Notwithstanding Mr. Weir's opposition the Orpingtons have taken beyond my most sanguine expectations, and this very fact should convince Mr. Weir that his opposition carries very little weight with it, as people continue to take the breed up with increasing enthusiasm; and during the present season (1898) more orders have been placed with me for eggs and birds of the Orpingtons than all the other breeds put together, and I keep every useful variety. I do not see why Mr. Weir should refer to the 'so-called' Buff Orpington. I have never deceived the poultry world in any way as to the origin of the Buffs. When I brought them before the public I told them exactly the breeds I had used in their production, and I was over ten years in producing the birds I introduced. In America the poultry fanciers welcome new varieties and breeds, but not so here in England, where some of the old breeders and writers seem to delight in ridiculing those who have done anything towards making the interest in poultry-keeping more general, and thus help to keep at home some of the money which is being sent out of the country annually. Notwithstanding Mr. Weir's promise of continued opposition, I am convinced that the Buff Orpington has a great future before it, and I cannot sometimes help thinking that those who are so strongly opposed to the variety are feeling vexed because they themselves had nothing to do with the origin of it. The praise I hear from those who keep Buff Orpingtons more than compensates for the unkind and even malicious remarks of those who have never kept a bird of this breed, and under this head Mr. Weir certainly comes."

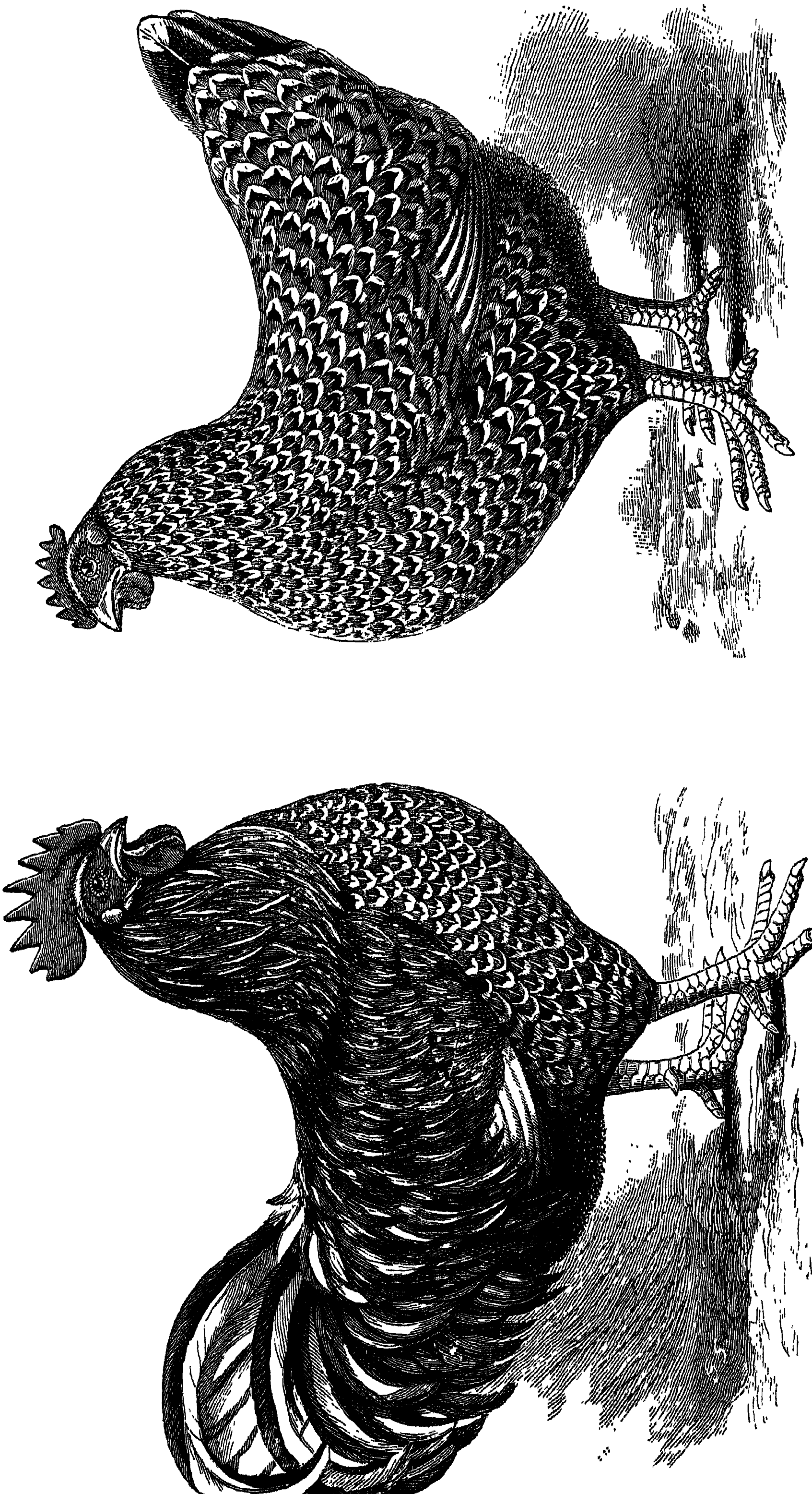
I have only now to say that a whole number of the *Gazette* would scarcely suffice to contain the correspondence on the above subject during the past year, but having gone carefully through every line of the discussion, it is not difficult to arrive at a conclusion as to which side the preponderance of evidence rested, suffice here to say that the remarkable continued popularity of these new fowls called Buff Orpingtons, and their acknowledged excellent qualities, is a complete justification for their introduction from whatever source; while for Lincolnshire Buffs, which were rarely heard of in the poultry press prior to 1894, they have now emerged from that obscurity which, in the absence of *The Feathered World* discussion, they were destined to remain, and as Buff Orpingtons have now become popular here, and the prospect of this popularity increasing, I have considered it right to record the whole story of their rise and development together with the formidable opposition they encountered in the early years of their yet brief but eventful history.

Diamond Jubilee Orpingtons.

Hitherto the productions in the poultry line which emanated from Orpington House, although of several colours, were but set colours, namely, blacks, whites, and buffs, and of these two varieties each single and rose-comb. These, however, did not satisfy the author, who, ever fertile in resources in the way of producing type and colour in order to secure an ideal, now proceeded to invent another variety, composed of several colours—a mottle—not of various coloured feathers, but several colours produced in each feather, and when these colours and markings can be bred to perfection it is said they will be the handsomest fowls we possess.

Mr. Cook said he had been making at these for a number of years, and first placed them before the public in 1897—Jubilee year—and named them Diamond Jubilee Orpingtons. Her Majesty the Queen, the same year, adding a breeding pen of this variety to her large collection of prize poultry.

The best description I can give of this the latest addition of the Orpington is from the author, who, in March of last year, twelve months after their introduction, wrote of them as follows:—"The rapid spread of the new breeds has been the wonder of the poultry world, and as one after another of them has been launched and absorbed by the great army of breeders, and as one after another splendid classes well filled have appeared at the various shows, the voice of controversy, which at one time meant only the voice of derision, has changed into one of praise and admiration. Nothing succeeds like success, and Orpingtons have succeeded, but the Diamond Jubilee Orpingtons have succeeded in a way peculiarly their own. We have been very glad to hear those who have tried them as table birds say they have never eaten such splendid fowls, and we are not surprised as they have been bred in such a way as will ensure this, and they will become better if they are carefully bred. The laying qualities of these birds are also very extraordinary; some that were hatched in February were laying in August, while the March and April chickens were laying in early September, and these



Diamond Jubilee Orpingtons.

laid all through the winter, some averaging 100 eggs up to the end of February, by the time they were twelve months old. The chickens grow as fast as any other of the Orpington varieties, indeed these and the Buffs grow if anything faster than the Blacks. They have not been out long, but we are having a run on the cockerels, as these are found especially valuable for crossing in the farmyards, and this is a valuable feature of the influence these birds are introducing into the already improved condition of things among the farmers' fowls.

"The immense vitality of Diamond Jubilee Orpingtons is proved by the fact of so many male birds being produced. We had three cockerels to every pullet hatched, and have been able to sell them all for crossing purposes, as for those who want all-round birds no better cocks can be found for the purpose. We are keeping large numbers of birds for stock purposes, as they are becoming increasingly popular, and the number of inquiries for birds and eggs of this variety renders it quite certain that this new breed of the Jubilee year will take first rank among the useful breeds.

"Those who buy eggs will find no difficulty in disposing of the surplus cockerels, as they are much sought after for crossing. We are often asked if we are of opinion that the Diamond Jubilee fowls will spread more quickly than the Buffs; but this we are not able to judge, as the latter spread so very quickly, but where they have gone it will not be difficult for the Jubilees to follow, and it is possible these speckled birds of such uncommon appearance may make rapid strides.

"We have had hundreds down to Orpington House to see the birds, and most of them have been delighted, the colour being a very taking one."

In a communication I received from Mr. Cook, in April of this year, he stated that the Jubilee fowls were then very popular in England, on account of their wonderful laying qualities and handsome plumage. Mr. Cook also kindly forwarded the two electros, the illustrations from which appear in this issue, and further states that during the past season he has bred a number of pullets equal in marking to that shown in the illustration, and to further assist us in our conception of the appearance of this handsome fowl. Mr. Cook forwarded feathers from different parts of the bodies of both sexes, which Mr. Grosse has kindly promised to reproduce in colours, for the final article on this breed.

Jubilee Orpingtons have not yet appeared in Australia, but already negotiations have been opened with Mr. Cook for the initial shipment of this variety to the Colony.

Blue and buff Orpington ducks have also been produced by Mr. Cook. Already two shipments of the former have come to the order of Mr. E. Butcher, of North Sydney, who has had a most successful season with them, and reports that the most wonderful stories which accompanied them have been fully justified by the results, several of the ducklings at ten weeks old weighing 5 to 6 lb. each. The buff ducks have not yet reached Sydney.

Having now dealt exhaustively with all Mr. Cook's poultry productions from early recollections, and other available sources, I now

purpose supplying an American journalist's impressions of the Orpington establishment, and also the opinions of an English editor who visited the place during the past year, these opinions and impressions being of especial value and interest to poultry-keepers generally, and Orpington breeders particularly.

An American Editor at W. Cook's.

In the early part of these papers, when bringing Mr. Cook under first notice at Chislehurst, about 1882, it will be remembered that he was only breeding a few cross-bred fowls in a back garden; still it was shown that he did that well, and the results of his labours from that small beginning can be seen from the following editorial article in a leading American paper called *Farm Poultry.* The editor in 1897 was commissioned to visit Mr. Cook at his residence, and contributed the following:—

"You will be greatly interested in what you see at Mr. Cook's; he has built up a great business and made lots of money by it," said one friend. "Cook has made money by booming 'mongrels.' Moral—If you want to make money boom mongrels," said another. "Cook, the Orpington man, is the best hated man in England, but that don't disturb him in the least; he doesn't care at all what people say about him, so that he sells birds," said a third. "Don't waste your time going to see *him.* Why he used to be a coachman," said a fourth. "By all means go and see Mr. Cook; he is one of the greatest, if not the greatest, poultryman in England; he has helped me more than all others combined." Such were some of the opinions expressed to me respecting the originator of the Orpingtons, and it may be surmised that I went to St. Mary Cray with considerable curiosity as to what manner of man Mr. William Cook might be. I had seen him for a moment in the Tunbridge Wells Show tent, but when a few moments later I asked one of my acquaintances to introduce me to Mr. Cook, he could not be found—had probably gone out to the horse-judging ring. So that when I stepped from the train and saw a short, thick-set, pleasant-faced gentleman waiting for some one, I recognised him at once, and addressed him by name. Expressing himself as much pleased to have a visit from the editor of *Farm Poultry,* he led the way to the carriage, and I saw that even if Mr. Cook was once a coachman he had now a coachman of his own, and that the coachman had a very handsome pair of bay horses to drive. Mr. Cook loves a good horse (most Englishmen do), and breeds horses as well as poultry. Arrived at Orpington House, our first visit was to the new stable, where was a pair of fine blacks and a hunter that had recently made a record jump of 6 ft. 3 in., doing it twice in succession, which abundantly proved that it was no "chance" achievement; and this turning at once to the stable and to horse talk, attested that Mr. Cook loved his horses quite as much as his poultry.

Orpington House is about five hundred years old, with an addition here and a wing there, and is wonderfully curious in construction—no two rooms being on the same level. "Mind the step up," or "mind the step down," being the precaution whenever we passed from one

room to another, as this or that quaint or curious feature was pointed out; and Orpington House is *a home* in the best sense of the term. That was evident at every turn. Calling to one of his men to fetch him a little grain, Mr. Cook invited me to accompany him around the farm. It is pretty much all poultry houses and runs, the nearly 50 acres of this home farm, and when I asked where the horse-raising was done, "Oh, on my other farm, 4 miles from here," was the reply.

Nearly every style of poultry-house is in use on Mr. Cook's farm, with a preponderance of houses with open-front scratching-sheds. In these the sheds are about four times the length of the roosting-pen, and there are two pens or sheds opening into each large grass run; the fowls in one house having the run of the yard one day and being confined in the shed and pen the next, while the fowls in the second house have the run of the yard, they having been confined while the first were out. The yards or runs were of many shapes and sizes, being built as the ground favoured, but were large, averaging about a fourth of an acre in area. A part of the land is wooded (or "plantation," as the English call it), and some of the houses are so placed that the fowls have part grass run and part wood run. As we went about inspecting the stock we came upon groups of visitors being shown about, and, in answer to my question, Mr. Cook said they had a great many visitors, fully 5,000 in a year—sometimes as many as forty or fifty in one day. "No. 1 man takes charge of the first lot, No. 2 man of the second lot, No. 3 man of the third, and if another lot comes, my son, or a clerk from the office, shows them around." Such a stream of visitors must be a heavy expense to show around; but, of course, many of them are buyers of stock or eggs, and the showing around is one of the ways of advertising one's stock.

There were a number of pupils about, assisting in this or that task. Mr. Cook said they had six to ten pupils usually—never more than ten. The pupils pay a fee of ten guineas each, and stay a month or six months—stay as long as they choose. They get board in the neighbourhood, and come and go pretty much as they please; learning in the main by observation, by seeing the work done.

Mr. Cook has two sons associated with him in the business; and the firm of W. Cook and Sons breed about every known variety of domestic poultry, including turkeys, ducks, and geese. They do an enormous business, as is evidenced by the fact that they keep four clerks employed in the office upon the accounts and correspondence. The egg shipments alone, from 1st December, 1896, to 1st September, 1897, amounting to 10,404 sittings, divided as follows:—

Fowls	7,897	sittings.
Ducks	1,535	,,
Turkeys	937	,,
Geese	35	,,
	10,404	sittings.

And that the egg shipments were still being made I had ocular proof at the station, where were eleven sittings on the truck ready to be put on the train.

The amount of stock sold is many times greater than that of the eggs, "but it would take a month's figuring to foot up the total."

At the time of my visit the stock in the houses and runs was low, as they had been shipping large lots of old stock, and had not brought in the new. It is their policy to sell off much of the old breeding stock at the close of the breeding season, and they put the price low at that time to clear them out, the result being very heavy shipments. A special feature of the business is pure-bred males for crossing, or for improving farmers' flocks, and a very large number of birds are sold for this purpose, of course being in the main birds not quite good enough to ship for pure-bred breeding.

In this connection it is worth noting on his letter head he puts this branch first, as follows:—"Birds for crossing, breeding, and exhibition purposes always for sale." As they breed from about three thousand head (of all kinds), there is a great quantity to sell. The number of chicks raised is many thousands, "probably ten thousand, possibly more," but the bulk of these chickens are raised on the other farm, and on fifteen or twenty farms of friends in other towns. This last is most common in England, very few poultrymen raising all their stock at home.

Mr. Cook is a frequent exhibitor at the shows, and has won over 1,000 prizes, cups, medals, &c. One bird he showed me had a record of thirty-two first prizes, eight specials, seven second prizes, and five third prizes, including the Palace, Birmingham, Royal Counties and Bath, and West of England shows; and another, a fine old single-combed black Orpington cock, had been shown five times and captured four firsts and one second prize.

A handsome rose-comb black Orpington cockerel was shown me that weighs now 10¼ lb., and was hatched the first week in January; and four cockerels of one hatch weighed together 36½ lb.; a buff Orpington cockerel hatched in March weighed now 10½ lb., and ought to make 13 to 14 lb. as a cock; and they had Orpington pullets which were laying at four months old.

The general poultry stock ought to be mentioned before the Orpingtons are considered, and yet a mere cataloguing of the numerous varieties would be tiresome. Mr. Cook likes the barred Plymouth Rocks, and has some very fine ones—and the same can be said of the Wyandottes, Silver and Golden, Black Langshans, Black Minorcas, White, Brown, and Buff Leghorns, &c. Of his turkeys, geese, and ducks he is very fond, and of the latter has a blue variety which is very promising, and is working to produce a "buff" variety with a good prospect of success. "The public wants buff varieties," said he, "and I propose to offer them a buff duck in the near future." [The Buff Duck is now in the market.—G.B.]

It is with the Orpington fowl that Mr. Cook's name is most prominently identified, so much so that he is frequently spoken of as "Orpington Cook," and upon that variety of fowls his reputation was chiefly built up.

In the preface to "Fowls for the Times, the History and development of the Orpington Fowl," Mr. Cook says:—"The Orpington

fowls have been brought into existence as part of a great plan I have under consideration for infusing into farming pursuits a new element of profitable poultry-keeping which shall, while it adds a new vigour to the industry, serve to correct the uncertainty which has served to increase since the ports of England were thrown open by freetrade to the produce of the world, and the English farmer, unable to hold his own, has gradually receded from his once important position to rely upon his hardly-held prestige, and to hope for better times. Orpingtons are suited to almost all conditions under which poultry can be kept, offering in the several varieties that choice which is always welcome, and such a difference of characteristics as make it possible for poultry-keepers of all classes to keep one or other of the varieties, and do well with them."

In other words, in creating the Orpington Mr. Cook aimed to create a practical fowl—a fowl that was a good layer and a good table-bird as well,—and in this aim he succeeded, probably beyond his own anticipations.

The Orpingtons are Single Comb and Rose Comb Black, Single Comb and Rose Comb White, and Single Comb and Rose Comb Buff. In addition to these Mr. Cook has made a beautifully-mottled variety, which he has put upon the market this year, and which he has named "Diamond Jubilee" Orpingtons. As we said above, Mr. Cook aimed at producing a *practical* fowl—both a good layer and a good table-fowl,—and that the buying public appreciated his work is proved by the immense number of Orpingtons found all over England to-day. The reasons for working as he did he gives as follows:—"The introduction of American breeds, the controversy which this aroused, and the bitterness of the old breeders all served to increase my interest in a question that became more and more absorbing and important in my opinion as I investigated theories and experimented with various breeds already in existence; and as one after another the points of excellence seem to become combined in various cross-breeds, it dawned upon me that here in this selection and collection of the best characteristics of fowl-life I had hit upon a most important factor in the future of practical poultry-keeping."

There is much meaning in the sentences—"The introduction of American breeds, the controversy which this aroused, and the bitterness of the old breeders," which cannot well be considered here, but that "bitterness of the old breeders" and their hostility to new (and improved) breeds is very surprising until one considers the monumental conservatism of the Englishman; he wants nothing "new," no matter how greatly improved.

England is importing over six millions sterling worth of eggs and poultry annually, and we would naturally expect an important movement, designed to check this great drain upon the country's resources, would be encouraged instead of met with bitterness, controversy, and sneers at "mongrels." If the making of two blades of grass grow where but one grew before deserves praise and encouragement, doesn't the making of a practical and profitable variety of fowls deserve praise and encouragement? The Orpingtons have all the strength

and vigour of cross-breeds, and as egg-producers, especially in autumn and winter when eggs pay the creamy profits, they are remarkable; they lay, likewise, the tinted eggs which command a premium in the market. They are of large size, are short-legged, chunky-bodied, and with the full round which indicates strength and vigour, and for an all-purpose fowl for the English market they seem to be just right. For the American market they have a most serious defect in their white flesh and legs.

Being pre-eminently a practical fowl, it is Mr. Cook's desire to keep them so, to have practical qualities take precedence over fancy points. He says: "One of the things we have yet to learn as a fancy is that it is the fowl, not its feathers, that should form the chief value of the bird itself. Egg-production and table qualities we must have, and so, with regard to Orpingtons, it is highly essential that, although beauty of plumage and points should always be studied, yet utility must always be kept in the first place if poultry-keeping is to command its proper position, commercially, in our midst. To ensure this the standard of judging must be based upon real usefulness, and fancy no longer be made the great standpoint, as the utility of fowls should be a proved thing by egg results and weight as table-birds, so that the judgment might be based upon facts that are beyond controversy. Of course the future usefulness of the show system must depend very largely upon the turn things take, as it may yet be that the market bench will be the most profitable show point of vantage for enterprising poultry-keepers; but it is wise to utilise every system that has any element of real usefulness in it, in order that all sorts of people may indulge their particular tastes and exert their own characteristic efforts. Poultry clubs would do well if they advocated strongly this utility judging, and in the scale of points for judging larger per centages should be allowed for points of real utility."

No wonder there was "controversy aroused" and "bitterness among the old breeders" at such teaching! Cook puts utility above fancy; away with him!

I have left scant space in which to speak of Mr. Cook's many other interests. He delivers some 130 to 140 poultry lectures each year, mostly in the winter months, delivering four or five a week for several weeks together, to classes in towns near together. He has written five books. Of the first—"Practical Poultry-breeder and Feeder; or, How to make poultry pay," over 35,000 copies have been sold. The Orpington book has been mentioned, and quoted from in this article. The others are "Ducks, and how to make them pay"; "Pheasants, Turkeys, and Geese;" "The Horse, its keep and management."

The Poultry Journal, is a monthly poultry paper edited by Mr. Cook, and in addition the firm of W. Cook and Sons are extensive dealers in poultry supplies, including all kinds of grain, various prepared poultry meals, roup powder, insect powder, ointment for scaly legs, leg-bands, grit, &c., and one of the sons conducts a depôt for these supplies in London. Certainly Mr. ——— was not far wrong in saying that "Mr. Cook is one of the greatest, if not the greatest, poultrymen in England."

An English Journalist at Mr. Cook's.

The above are the views, impressions, and opinions of a celebrated American poultry journalist of Mr. Cook and his establishment in 1897. A year later the editor of a successful London weekly journal also paid a visit to Orpington House, and furnishes the following report from an English point of view, which is confirmatory of the preceding, as also of the rapid annual growth and magnitude of the Orpington establishment:—

"During recent years poultry-farming has been much discussed as a profitable business in itself, and an additional source of income to farmers and agriculturists. With the *pros* and *cons* it is not the intention of the writer here to enter on, but rather to describe shortly what has been done in a few years by energy, perseverance, and business acumen, in building up probably the largest establishment of its kind in England.

"A dozen years or so ago, Mr. William Cook, of Orpington, in Kent, had collected together a moderate number of various breeds of poultry, and, aiming at perfection, had, by judicious and scientific crossing, obtained a breed which combined the useful qualities of a good table-fowl with the power to produce the maximum number of eggs per annum. To this breed he gave the name of Orpingtons.

"First came the Black Orpingtons, which became almost at once popular with poultry-breeders who desired fowls of all-round utility. Then Mr. Cook evolved the buff variety, which immediately jumped into public favour, being still more suitable for table purposes, having the white legs so desired by connoisseurs of table poultry with the same egg-producing qualities of their black brethren.

"So wonderful was the demand for these birds that Mr. Cook had to seek for larger grounds, and removed his yards to their present quarters, Orpington House, St. Mary Cray, where he has laid out many hundreds of acres with pens of his favourite breeds of Orpingtons, and in addition he has almost every other variety of fowl and duck known to the poultry-breeder. These also are all specially selected for their egg production, and as the business assumed its present proportions the founder took his two sons into partnership.

"Visitors to the poultry yards are always welcome on any week-day, and on Bank holidays the number that journey to St. Mary Cray to visit the homes of the Orpington assumes a goodly total, the record of one day being 560 persons.

"The farm is apportioned off into runs of different sizes, all on grass. In some are the *creme de la creme* of the breeding stock, consisting of a cock and six or eight hens. Some of these pens are arranged in a wood, which shades the occupants from fierce sun in summer, so preserving the delicate tints of the plumage. Each run has its comfortable house in which peat moss is liberally used on the floor, and the eggs are collected thrice daily, so ensuring their absolute freedom from the risk of partial incubation which might occur from successive hens laying in the same nest.

"In an extensive plantation planted with fruit-trees are large pens containing hundreds of birds for sale, each variety being of course in separate pens.

"The ducks, geese, and turkeys have a large park to themselves; here, again, the different varieties are kept apart. Of the turkeys, there are a fine flock of the American bronze breed, for which Messrs. Cook are famous, and they keep the strain up by importing choice birds from America every season. These birds grow to an immense size, the cocks attaining, when in their second year, up to 42 lb. weight.

"Of the ducks, mention must be made of the Blue and Buff Orpingtons, two varieties made by Mr. Cook in recent years, the former combining the necessary qualities for table purposes, of quick and large growth, together with being good layers, while the buff are specially valuable as layers. These ducks have 'caught on,' as the saying goes, and numbers have been exported to the colonies. In talking over the various merits of his breeds with Mr. Cook he remarked that the different breeds varied in popularity from time to time. During the past two years the Buff Orpington fowl has held the premier place, more of this variety being bred and sold throughout England than any other pure-bred fowl.

"All buff-coloured fowls, Mr. Cook says, are popular. Buff Leghorns, Plymouth Rocks, Cochins, and Wyandottes sell well, and of these he has large fine pens among his immense collection.

"A few figures, compressed on account of space, will prove interesting. The breeding yards at Orpington House contain 8,000 birds, and last year 1,500 prize birds were reared. The larger majority of these were sold and won prizes for their purchasers, but Messrs. Cook have themselves won over 2,500 prizes to the end of 1898, and many cups at the best shows, including the Crystal Palace, Birmingham, Liverpool, The Dairy and Poultry Club Shows.

"In 1898 they sold 11,635 dozens of eggs for sitting, and besides reared at their farm, and with persons in their employ, 25,000 head of pure-bred poultry, of which 20,000 were sold for breeding purposes, being despatched to customers in every part of Great Britain, America, South Africa, Australia, and other British colonies, and from September to March the weekly total of export coops frequently mount up to between 70 and 100. Mr. William Cook is the author of various books on poultry and horses, and his publication, 'The Practical Poultry Breeder and Feeder,' has extended to 43,000 copies, a proof of the value and interest of the work.

"To any one interested in poultry matters a visit to the home of the Orpington, St. Mary Cray, will show how poultry can be made to pay under good and careful management."

(*To be continued.*)

Outbreak of Phylloxera in the Goulburn Valley.

IMMEDIATELY on receipt of the news concerning the discovery of phylloxera at Toolamba and Armona in the Goulburn Valley District, arrangements were made for the Viticultural Expert (Mr. M. Blunno) to visit Victoria and co-operate with the officers of the Victorian Department in ascertaining the nature and extent of the outbreak. Upon his return the Viticultural Expert visited Albury, to discuss with the vignerons the best steps to take to protect their vineyards from infection, as well as to arrange for a systematic inspection of the district.

The following extracts from Mr. Blunno's lecture, delivered before the Albury Vine and Fruitgrowers' Association, should be of interest to all concerned in the viticultural industry:—

"When two vine-growing districts, one infected and one still clean, are distant something like 80 or 90 miles, as is the case with Toolamba and Armona districts in respect to the Corowa and Albury districts, phylloxera can only so far be communicated through parts of vines apt to carry the disease. If the Victorian Government stick to the policy of systematically inspecting the vineyards of the Goulburn Valley and all those planted in the north-eastern country stretching towards Rutherglen, and take drastic measures as soon as a fresh outbreak occurs, it will take several years before phylloxera would by its *natural spreading* reach vineyards this side of the Murray. I say natural spreading intentionally, because if you import cuttings or rooted vines from those infected vineyards or anywhere else, in Victoria or any other part of the world, you may infect this district to-morrow.

"The Infection of Toolamba and Armona.

"The infection at Toolamba extends over an area of about 90 acres, all very badly infected, so much so that last season they hardly bore any fruit at all. The vines cultivated are all Gordo Blanco, have been grown in a very stiff clay, and were irrigated. The Government there are trying to trace the origin of the infection. There are nine vineyards, making altogether, as I have stated, about 90 acres. They are all in one block; in eight of them has been found phylloxera, and the rooted vines came all from one place. In the ninth vineyard in which the pest has not been discovered, although just alongside the infected ones, the rooted vines came from another place. Two more infected vineyards are at Armona, about 7 miles from those of Toolamba.

"Only two years ago we had to refuse admission to 20,000 vine cuttings of Cabernet Sauvignon bought of a vigneron in the Goulburn Valley by a gentleman who wanted to plant a vineyard at Cowra. A certificate from the entomologist of Victoria testified that no phylloxera could be found in that vineyard, nor in any vineyard within 50 miles.

Well, the fact is that now, after not quite twenty months, phylloxera has been found within only 28 miles over an area of nearly 100 acres! and, certainly, the infection is over 20 months old. I have had a long experience in matter of tentative as well as intensive inspections, and I know how far tentative inspections can be relied upon. Now, I am very glad to have reported against the admission of those 20,000 vine cuttings of Cabernet Sauvignon into New South Wales from the Goulburn Valley.

"The Best Policy of Dealing with the Pest under the Present Circumstances.

"It seems to me that some vignerons of this Colony are under a false impression as to the best policy in checking the disease, attenuating its ravages, and possibly eradicating it altogether from the now infested district. This is in the county of Cumberland, while in the Corowa and Albury districts a few vignerons are agitating in favour of the immediate importation in the Riverina vine-growing districts of the American phylloxera-resistant stocks. Everything connected with the phylloxera policy is a very delicate question. It has been, and it is so everywhere, not only in Australia, but in Europe also; so many different and clashing interests, so many people competent or not, ready to give advice. All this, of course, has the effect of disturbing that serenity of judgment which is so absolutely necessary in those best qualified by science and practical experience to take in hand the whole business, and manage it in the best possible way under the circumstances. An everlasting interference in connection with the administration of the law concerning phylloxera will only result in a shifting and spasmodic policy, which is no policy at all, and in a few years will be confusion, while phylloxera, obeying its natural laws, breeds and spreads and makes ravages. Against such systematic action on the part of the insect, another systematic action should be taken to cope with the disease, otherwise it is better to throw up the sponge.

"In the county of Cumberland the inspection of vineyards is organised according to the latest knowledge of the life-history of the insect. Five inspectors, each assisted by two men, visit the vineyards of Cumberland all the year round, and most places are visited two or three times in a year. The inspection is a very close one. In vineyards located rather far from old or recent sites of infection, one vine in ten is carefully examined, while in those within short distance from them, one vine out of five, or four, or three, or every other vine, or even every vine is examined. By so doing we have been able to discover vineyards of 5 or 6 acres in which only a dozen vines were infected, and very slightly infected too. This system, if continued for a reasonable length of time, must tend to check the spreading of the disease, and if the vignerons would only co-operate with the Government by not sending out of the vineyards rooted vines or cuttings, or importing any from abroad, in all probability we would eradicate the disease from the country. But the worst is that, in spite of a proclamation forbidding growers to send out of a vineyard any vine or part thereof unless duly disinfected, vignerons continue to do so freely,

and there is no way of checking it, because it is impossible to place a policeman in every vineyard. The present Vine Disease Act is faulty in some of its clauses, so we must make a strong appeal to the patriotism of every man, and impress upon the vignerons that this removal of cuttings and rooted vines from place to place without the necessary precautions is practically a crime. Whenever and wherever we detect the disease we take prompt and resolute action, the vineyard is destroyed, the ground thoroughly disinfected with heavy doses of bi-sulphide of carbon, and as far as the departmental action goes it is certain that, from a technical point of view, the work is done according to the best information available as to the biology of the insect, the effects of the bi-sulphide of carbon, and so on. But I am always afraid that while we stick to a systematic action, which should lead the Department to success, possibly the negligence or ignorance of one or two vignerons or nurserymen will destroy or spoil the work done by the Department, which cost so much time and so much money to the country. When we consider the harm accruing to the whole industry through the meanness of a few who, for the sake of a paltry benefit, forget a national duty, I cannot find words strong enough to stigmatise such action. These considerations are suggested to me by a recent occurrence in Cumberland, where a vigneron whose vineyard was badly infested had sold or made presents of some cuttings and rooted vines to three friends of his. We found phylloxera at one of these three places, 3 miles away, on the outer zone of infection. We have visited the other two places and failed to see anything yet, but of course they are under close observation.

"We often hear that the policy of destroying the infected vineyards in the county of Cumberland is a ruthless work. The statement comes, of course, from a certain section of the vignerons of the county, while the Department often receives strong protests from the associations of vignerons of the Riverina pointing out that energetic action is required to prevent the spreading of the disease.

"Some vignerons of Cumberland are getting pessimistic about phylloxera. That is a fault. Suffice it to say that when on April, 1898, about fifty vines had been discovered to be infected in a small vineyard at Canley Vale, and the Department uprooted the whole area, strong remonstrances were made in order to save half of that vineyard, alleging that this second half had been found clean, and was situated some 50 or 60 yards away from the infested section. The very people that should have eulogised the action of the Department condemned it. Those people had their vineyards quite close to the condemned one, and could not understand that any half measure which would have left traces of the pest behind would have been a serious threat to their own vineyards. They would not believe that phylloxera is easily carried from an infected section of a vineyard to a still clean portion of the same vineyard through the implements, and that the fact that the inspector failed to detect the pest in the second section did not prove that such section was really free from disease. In fact, it is almost impossible to discover the disease when there is only a trace of it.

"In the county of Cumberland vineyards are generally scattered. This condition is a natural check to the contamination of clean vineyards from infested ones. That is the reason why the so-called extinctive system commends itself for adoption, and that is the reason why, though phylloxera has now been known for the last fifteen years, it has made relatively little progress.

"The Curative System.

"The curative system consists in injecting in the ground a smaller dose of bisulphide of carbon than that given in the extinctive method. In the first instance, you spare the vines but you do not kill all the insects; therefore you ought to make the application of bisulphide of carbon, or its substitute, the sulpho-carbonate of potash, every year, otherwise your vineyard will be reinvaded again and die in a few years. The expenses entailed by the application of the curative system are such that only vineyards producing very high priced wines can stand; in fact, to my knowledge the curative system is adopted in some vineyards of the French districts, very well known for their wines, which command very big prices, but this is not the rule. These expenses are still made heavier through the necessity of heavy manuring in order to repair to the losses suffered from the vine through the presence of phylloxera. The cost of the cure would be, in this country, something like £8 or £10 per acre per year, and, needless to say, the Government then could not pay for the bisulphide or for the labour any more than they pay for the sulphur or Bordeaux mixture to check oïdium or black spot. Flooding the vineyard is another system of curing the vineyard from phylloxera, but I do not wish to treat this argument of the curative system, for which, so far, there is no prospect in this district.

"The fact that the Continental States, like Germany, Austria-Hungary, Italy, Switzerland, Spain, Algeria, and the Balkanic States are still sticking to the extinctive system wherever there is chance to eradicate or, at least, check the disease and localise it within a limited zone should suffice to demonstrate the wisdom of the policy followed by our Department.

"Of course, in France the same system could hardly be followed, considering that phylloxera is all over it. Yet it is adopted in Algeria, where the conditions of the infection are not so alarming as they are in France. Indeed, I am surprised at the opposition which the Department encounters in carrying out the extinctive system in the county of Cumberland. If the Department were to relinquish its solicitude only for a few years, phylloxera would spread so widely that it would soon ruin the vine-growing community of that county. I have already mentioned what a failure is the curative system, which, by the way, is technically impracticable in soils of a certain texture. In all cases the *modus vivendi* between the vigneron and phylloxera involves an arrangement very costly to the vigneron, which after a little while would change to a *modus moriendi*."

Bee Calendar.

ALBERT GALE.

July.

Bee management differs very little during the winter months. The latter part of May, June, July, and the early part of August are the times beekeepers can take their holidays to visit their friends—that is, if they have nothing in the shape of bee appliances to construct or repair. Bees, if properly put up for the winter months, should not be opened till the days begin to lengthen and the warmth increase; then you may look in and note if there are any empty combs that require to be removed. If the bees have not food enough, see that they are well fed as spring comes on; it will induce to early swarming.

Occasionally lift the lid of the hives, and note if there be any dampness; find its cause, and cure it, especially if it be a leak in the roof. Dampness engenders all sorts of troubies among the bees. In the coldest parts of the Colony, between the quilt and the lid of the hive put a layer of old newspapers; it will greatly add to the warmth of the bees.

Poultry Experiments at Hawkesbury Agricultural College.

A practical poultry-keeper, noticing paragraph at head of page 570 in June number of *Gazette*, would like to see the results of carefully-conducted experiments carried out on the following lines:—

(*a*) What is the weight of average pair of Aylesbury or Pekin drakes at (say) 14 weeks old, and what weight of food they ate during that period?

(*b*) As above, but with Muscovy drakes?

(*c*) As (*a*), but with a light breed of roosters?

(*d*) As (*a*), but with a heavy breed of roosters?

The object is to ascertain the ratio between food consumed and the increase in weight. It would be desirable to ascertain these matters every fortnight during the period indicated.

The writer is carrying on a small experiment himself, but has not sufficient time at his disposal to extend it so as to obtain a fair average result. Mr. Ellis, of Botany, was asked the question, but although a breeder of many hundreds, he was unable to answer it.

Farm Notes.

NORTHERN RIVERS DISTRICT—July.

H. V. JACKSON.

PLANT out some potatoes in ground that is well drained. Early Rose and Brownell's Beauty gave the most promise at the farm last season. There should be a good supply of Jerusalem artichokes available for digging up, as the roots may be required, and a new plantation of this vegetable may be formed. The ground should be well prepared and manured, and the tubers planted in rows 2 feet or 3 feet apart; the trenches should be 5 inches or 6 inches deep, and the tubers dropped in about a foot apart and covered up.

Sow peas freely.

Tomatoes may be planted out if the young plants are large and strong enough; but they will require to be protected at night, or else a chance frost may kill them.

Look over onion beds frequently, keeping them free from weeds, and the ground between the rows hoed so that it is free and open.

Plant out cabbages, cauliflowers, leeks, lettuce, and savoys.

In warm localities chillies may be planted out, but not where frost is likely. Make a sowing of broad beans, red and silver beet, cabbage, cauliflower, endive, lettuce, parsnip, raddish. If cucumbers or melons have been raised in frames, and planting out is thought advisable, the plants will require most careful protection every night, for very little frost will kill them.

If plants of rhubarb are obtainable, plant them out about 3 feet 6 inches to 4 feet apart in rich, well-manured land.

Sow lightly of French beans in warm localities only; also in well-sheltered and warm places teosinte may be sown, also *Setaria germanica*, otherwise known as Hungarian millet.

Mangolds, Swedes, kohl-rabbi, carrots, and turnips may be sown.

Get land well prepared, so as to be ready for early maize-planting. Rye, wheat, oats, and barley may be sown for green crops.

Where fallow land is bearing succulent weeds, plough them in; but fork up and remove objectionable weeds in the shape of docks, couch-grass, &c., and burn them. Heap up and make compost heaps of sweepings and all rubbish that will rot down, and conserve all animal manure under cover.

In the orchard planting should be gone on with. Pruning of the fruit-trees should also be taken in hand, and where limbs and branches are found perforated by borers, &c., burn such immediately. Save the sound prunings for pea-sticks, &c. When the trees are pruned give the main stems and barrel of the trees a thorough cleaning with

a good stiff brush; after that has been done, clean up the ground around the trees, and give a dressing of kainit. If stable or farm manure is obtainable, or can be spared, spread a good dressing round the tree; but do not allow the manure to be so close as to lay up against the bark of the main stem. For cleansing trees, whale-oil soap has been found excellent. The following are the proportions used in making an insecticide:—

Whale oil soap (80 % strength)	20 lb.
Sulphur	3 „
Caustic soda (98 % strength)	1 „
Commercial potash	1 „
Water—sufficient to make 100 gallons.	

Place the sulphur, caustic soda, and potash together in about two gallons of water and boil for an hour. Dissolve the whale oil soap in water by boiling; mix the two and boil them together for a short time; then use it at about 130 degrees Fah. In fighting Red Spider and Scale, an emulsion may be added to the above wash, composed of:—

Kerosene	1 gallon.
Whale oil soap	$\frac{1}{4}$ lb.
Water	$\frac{1}{2}$ gallon.

Dissolve the soap in water, and when boiling add the kerosene. Churn the mixture with a syringe until thoroughly emulsed, when it will be creamy-white in colour, and no oil floating on the surface. Add this to the 100 gallons of spray mixture previously described.

In discussions that take place on food-stuffs for dairy cattle, the dairyman frequently meets with terms that are not perfectly clear to him. At present the dairy-farmer does not make a study of feeding his stock, depending almost, if not entirely, upon his grasses. The day is coming, however, when it will probably be found advisable and payable to give more attention to this subject, especially at certain periods of the year, in this district. The carbonaceous component parts of a ration are those that have heat and fat-producing constituents. The nitrogenous component parts are those that go to form flesh. A so-called well-balanced ration, therefore, contains carbonaceous and nitrogenous constituents in the proper proportion for the production of fat, flesh, milk, &c. In the case of the dairy-cow, when her food has supplied the necessary heat and renewal of the tissues of her body which Nature demands, the surplus food will go to make either milk or flesh. The foods producing heat contain the most fat and starchy material, such as silage, green-fodder, turnips, mangolds, beets, arrowroot bulbs, sweet potatoes, and other root crops. The term nitrogenous is used somewhat generally, as it includes proteids and albuminoids. Proteids enter into the composition of the tissues; and as protein exists largely in wheat, oats, bran, peas, clover, &c., which foods are valuable for renewing the system and accelerating the production of milk. It will, therefore, be understood why, in feeding, one description of material is not advisable, but with so many pounds of silage or green-cut fodder or hay per day, a ration

of certain proportions in addition is recommended of grain or oil-cake or meal of one kind or another.

The following table gives some particulars of the contents of various food-stuffs; but figures of this nature must not be accepted as actually correct in all cases—different qualities of the same grain would no doubt differ in testing :—

	Nitrogenous.	Carbonaceous or Non-nitrogenous.		Inorganic.		Water.
		Starches and Sugar.	Fatty Matter.	Saline and Mineral.	Woody Fibre.	
Oats	12·90	53·80	6·00	3·50	10·80	13·00
Beans	25·50	45·90	1·60	3·10	9·40	14·50
Barley	10·60	63·70	2·00	2·60	7·10	14·00
Maize	10·40	68·50	5·10	1·60	3·00	11·40
Bran	14·20	50·40	4·20	6·10	11·00	14·00
Linseed	20·50	19·60	37·00	3·40	7·20	12·80
Hay...	9·70	41·00	2·50	6·20	26·30	16·00
Clover-hay	12·30	38·20	2·20	5·30	26·00	14·30
Rye-grass	3·37	12·02	0·91	2·15	0·06	71·43
Meadow grass ...	3·50	9·20	·80	2·00	4·50	80·00
Lucerne	3·83	13·62	0·82	3·04	8·74	69·95
Clover	4·27	8·45	0·69	1·82	3·76	81·01

Dr. Fream, LL.D., gives the following as the composition of Swede and mangel :—

	Albumina Compounds containing Nitrogen.	Starch, Digestible Fibre.	Sugar.	Mineral Matter.	Woody Fibre.	Water.
Swede	·98	2·74	5·54	·66	·85	89·23
Mangel	1·12	3·08	6·41	·81	·78	87·80

While cattle, well cared for in the matter of food, will, no doubt, look better, and should, in the ordinary course of Nature, give the best results, the breed and constitutional tendency of the strain will be the most important factor. Guenon, the French breeder, who made a close study of the milk cow, and brought forward the treatise on the value of the escutcheon as a guide to milking qualities, says that his experiments over thirty-five years prove to him that the greatest care should be exercised in considering the qualities of each parent as it may affect future offspring, and that from the union of a bull of large size, and of the first order, with a cow of less size and lower order, their results are offspring stronger and of higher order than the mother; while, if the superiority be in the cow, the bull being inferior, then the calf will be inferior to the mother in its milking qualities. The composition of milk of different breeds, as given by the New York

Experiment Station, for one year, is quoted by Professor Smyder, as follows; but such figures are for illustration, and not a direct criterion as to the superiority of one breed over another; climate, the strain of the breed, the character of the country and its grasses, and the manner of handling and feeding, and other factors, under different circumstances, would possibly give results slightly or perhaps altogether different:—

Breed.	Total Solids, per cent.	Fat, per cent.	Casein, per cent.	Milk-sugar, per cent.	Ash, per cent.
Jersey	15·40	5·61	3·91	5·15	0·74
Guernsey	14·60	5·12	3·61	5·11	0·75
Devon	13·77	4·15	3·76	5·07	0·76
Ayrshire	13·06	3·57	3·43	5·33	0 70
Holstein-Freisian ...	12·39	3·46	3·39	4·84	0·74

Though convenient rains have fallen in this district, the weather has continued droughty in other parts, and taking past records as a criterion, and appearances so far, it leads one to the conclusion that there is a possibility of a trying dry spell even here for a few months, more especially over September, October, and November; therefore those who have the means and the crops will do well to prepare a stock of silage; it will be found very useful.

A good deal more attention is now being given to pig-raising than formerly. The Large White Yorkshire, the Berkshire, and the Tamworth, appear to be the favourite breeds with many pig-raisers. The Large White are prolific breeders, and may be brought up to an immense size; the meat is of good quality.

The Berkshire, or what is called the improved Berkshire, is a breed in high favour, whether pure or for crossing with inferior breeds. The characteristics of the breed in their appearance are that they are black, with white feet, sometimes with a white spot between the eyes. The present type is the result of judicious selection and crosses, and is esteemed for evenness of flesh.

The Tamworth is a well-known old-established breed of pig, valued to an extent on account of its hardy qualities in looking after itself, and it makes excellent bacon. In this district, where there is so much rain and mud and slush, extra care is requisite to keep the sties clean. Arrangements should always be made to have separate sties for the young, the old, and those that are in pig. It is usually found that litters do best that are born in the earliest months of spring; they become well-established before the very hot weather arrives. On the other hand, the early autumn is the next most favourable period, so that the youngsters are getting along before the worst cold of winter is experienced. The period of gestation with a sow is 120 days, or, say, four months. In cold weather the pig-food should be heated, and should be of a mixed character—the use of only one description of food may cause the production of too much lean meat, or too much fat, or render the flesh.

flabby or hard, as the case may be. Too much maize is not a good thing used alone. Frequent feeds of only as much as they will clean up, is better than too much food presented at long intervals. Some rock-salt should not be forgotten for the pigs as well as for other stock. Avoid in-and-in breeding. Provide plenty of space for exercise. If properly fed and given sufficient space for exercise, the sow will not be feverish and unhealthy, or voracious, and there will be less risk of her eating her young pigs. An excellent food for the brood-sow, about a month before farrowing, is a slop of wheat-bran and oil-meal, with a few carrots, or apples, or potatoes daily. For making the slop, use about seven parts of wheat-bran to one part of meal. Arrange the quarters in such a way that by means of a dividing partition the little pigs may be fed apart from the brood-sow, and the sow, who at this time requires generous feeding, will also obtain her proper quantum of food. Shelled corn and milk, with the addition in course of time of broken wheat, may be fed to the young pigs, who soon learn to crack the corn. After weaning at the age of six or eight weeks, they will require the best of care to bring them on as marketable products. Barley-meal or oatmeal may be used with sharps or pollard, gradually reducing the sharps till at four or five months the food consists nearly entirely of meal. If obtainable, broken wheat or screenings served with bran, and a little corn as a thin sop twice a day will have marked results. The feed-troughs and drinking-tanks, also the casks, or tanks, or boilers in which the food is prepared, should be frequently scalded out and thoroughly scrubbed clean.

Arrowroot bulbs should be cooked, *i.e.*, boiled or stewed, for pig-feed.

Some pigs are very subject to inflammation of the lungs, especially if exposed to sudden changes of temperature and wet. When the symptoms are mild, cooling medicine is necessary, and the following may be beneficial:—$1\frac{1}{4}$ oz. cream of tartar, $\frac{1}{2}$ oz. saltpetre, 1 drachm tartar emetic, dissolved in hot water and mixed with food. The above quantity to be given every twelve hours, until the symptoms show signs of abating; the animal to be made comfortable with bedding, &c. In serious cases where there is much coughing, and the temperature is very high, bleeding is sometimes attempted as a remedy; but when the disease has progressed so far it is frequently hopeless. In very hot weather occasionally a pig may become stricken with apoplexy; and it is, in fact, an overflow of blood to the head. Sometimes the animal drops dead without warning, in other cases it comes on with staggering and loss of the fore-legs, the breathing rapid. If the symptoms are noticed soon enough, give $1\frac{1}{2}$ drachm of tartar emetic, 4 oz. Epsom salts, in some gruel or linseed meal, repeating every twelve hours, if necessary. If the animal recovers, feed lightly only for some days. During the hot season a red soreness and cracking behind the ears is sometimes a trouble. The part should be well washed and an ointment applied, made up of the following:—$1\frac{1}{2}$ oz. sulphur, $\frac{1}{2}$ oz. powdered hellebore, $\frac{1}{2}$ oz. muriatic acid, $\frac{1}{4}$ oz. carbonate of potash, 4 oz. lard. Melt the lard and add the carbonate of potash, stirring well together until thoroughly mixed. Remove the vessel from the fire and add the other ingredients; when ready rub the parts

with the ointment on a piece of soft rag. The one application will, probably, remove the irritation in a day or two, when the parts may be washed again, and when dry apply the following :—1 oz. camphorated spirits of wine, ½ oz. olive oil, ½ oz. solution of sub-acetate of lead.

Mange in pigs has a peculiar appearance and, in consequence of rubbing, disagreeable scabs or sores are formed. The complaint is infectious, therefore the animal should be at once isolated. The animal may be washed with a strong solution of soda, which should be allowed to dry on the skin; then apply the ointment of sulphur and other ingredients named above. In two days wash the pig again with a strong solution of soda—say ½ lb. of soda to 2 quarts water. When the mange is first noticed and treatment is commenced, give the following once a day, every day for a week, in the food :—1 drachm tartar emetic, ¼ oz. sulphur, ½ oz. nitre. In regard to the ointment always put it on with a soft rag, not with the hand. In all cases of inflammation and fever aperient medicines are the best—Epsom salts up to 3 oz., and sulphur up to 3 drachms, according to age.

Green food such as lucerne or clover is always very beneficial in keeping the bowels healthy. For bedding, wheat-straw is generally considered the best.

A few medicines should always be kept on hand by the stock-keeper, but care should be exercised in having them under lock and key. The following is a list of useful medicines that should be obtained in glass-stoppered bottles :—

Aconite tincture	6 oz.	Linseed oil	2 qts.
Arnica	6 oz.	Magnesia, sulphate of	8 oz.
Ammonia, spirits of	6 oz.	Nitric ether	6 oz.
Aloes—Barbadoes	4 oz.	Opium tincture	6 oz.
Camphor	3 oz.	Potas., chlorate of	6 oz.
Carbolic acid (liquid)	8 oz.	Potas., nitrate of	1 lb.
Treacle	1 tin	Sulphur (powdered)	1 lb.
Friar's balsam, small bottles ...	2	Turpentine, oil of	1 gal.
Gentian	8 oz.	Linseed meal	2 lb.
Ginger (powdered)...	1 lb.	Lint	1 lb.

It is much better for inexperienced persons to obtain any medicine required ready prepared from a druggist where circumstances will permit. Useful and necessary appliances are :—1 metal enema, 1 drench bottle (metal or horn), 1 metal funnel, 1 4-oz. syringe, 1 2-oz. syringe, 1 set of scales (1 gr. to 4 oz.), 1 zinc pint measure, 1 4-oz. glass graduated, 1 minim glass graduated.

The following are the symbols used by druggists :—

For Weight—		*For Measure of Capacity—*	
One grain	gr.	One minim	mj.
One scruple	℈j	One fluid drachm	fl. ʒj
One drachm	ʒj	One fluid ounce	fl. ℥j
One ounce	℥j	One pint	Oj
One pound	1 ℔	One quart	Qt.j
		One gallon	Cj

In cases of sudden colic a useful draught in an emergency is 16 oz. linseed oil, or say 1 pint, 2 oz. oil of turpentine, 1½ oz. tincture of opium; and an excellent remedy for horses is 1½ drachm of camphor and 1 oz. of nitric ether in 12 oz. of water.

RIVERINA DISTRICT—July.

G. M. McKEOWN.

Wheat.

Owing to the recent rainfall, the prospects of obtaining some return for labour in preparing land and sowing seed have greatly improved.

All growing crops should now be tilled by harrowing to a depth of not more than 2 inches, thereby conserving moisture and promoting more vigorous growth.

Lucerne.

May be sown during the next two months, as at this season the crop is more successful in getting ahead of weeds than is the case with autumn-sown crops.

Alluvial flats are preferable for lucerne. The land should be deeply worked, and brought to a fine condition.

For pasture, 3 lb. per acre has proved sufficient, but for hay 8 to 10 lb. of seed will be required. Where practicable, the seed should be sown by means of the drill.

Sheep's Burnet.

Excellent results have been obtained in this district, where the plant has proved its drought-resistant and fattening qualities.

The land should be thoroughly prepared, and the seed sown at from 8 to 10 lb. per acre.

Barley.

May still be sown for green fodder in well-tilled and manured land. Drilling the seed will in all cases prove the best method of sowing.

In the kitchen garden all growing crops should be well tilled and kept free from weeds.

Sow cabbage, cauliflower, onions, beet, and peas.

Plant out artichokes, cabbage, and cauliflower.

Sow under cover for early transplanting into beds, free from access by frosts, tomatoes and cucumbers.

HAWKESBURY DISTRICT—July.

GEORGE VALDER.

Farm operations for this month will mostly consist in getting land ready for spring sowing. The rain during the past month has put the land into good condition for cultivation, and every opportunity should be taken to get ready for early sowing of maize, pumpkins, melons, potatoes, etc.

Green Fodder.

In order to keep up the supply of green fodder for dairy cattle, etc., sowings of oats and peas, or barley and tares, should still be made. During the showery weather every opportunity should be taken to transplant field cabbages and also to get out cuttings of saltbushes and other fodder plants.

Onions.

Onions can still be sown, and the seedlings transplanted. Choose, if possible, well sheltered situations; when exposed to winds, plant shelter-breaks of strong-growing varieties of cereals.

Tobacco.

Seed-beds should be prepared, and early sowings made. The young plants are very sensitive, and will not stand frost; the beds should, therefore, be covered with frames of brush, hessian, or glass. Make the seed-bed in a position where it can easily be drained. Procure a quantity of good soil, as free as possible of weed seeds, and mix it with well rotted farm-yard manure. Long narrow beds, say, about 3 to 4 feet wide, are the best. When the bed is formed pile a quantity of brushwood on it and set fire to it, taking care to burn when the soil is fairly dry on top. This will destroy many of the weeds' seeds, and the fine ashes will act as a manure. Rake off all the lumps of charcoal, and bring the top soil to as fine a tilth as possible. Place boards along the sides for the frames to rest upon, allowing a good fall from back to front. The seed being very fine, it is difficult to sow it evenly. The best plan is to mix it with wood-ashes, and sow broadcast over the beds, sowing first in one direction and then crossing; then press the soil lightly with a board to cover the seed, and place fine brushwood or litter over the soil to keep it from washing. Frequent waterings will be necessary.

Rape and Mustard.

Small sowings can still be made. Should the season prove favourable these crops will make very rapid growth, and can be fed off in time for preparing the land for the late maize crops.

Lucerne.

The land should be ploughed as soon as possible, and got ready for spring sowings. On the lighter loams ordinary ploughing is often all that is required, but on the heavier soils deep ploughing or subsoiling is necessary. Once the plants become established the character of the subsoil is of greater importance than that of the surface soil. Lucerne requires peculiar conditions of soil and climate; being such a valuable crop it is worthy of trial in districts even considered unsuitable for it, as although it may have failed in most of the soils of a district, there might be a soil there suitable for it on which it has not been tried.

Field Peas.

Field peas for feeding to pigs, &c., can still be sown. Golden tares are also good for this purpose.

Orchard Notes.

W. J. ALLEN.

July.

During this month the orchardist will be exceptionally busy finishing his pruning, winter spraying, removing all rubbish and prunings from the orchard, handling citrus fruits, and towards the latter part of the month ploughing should be commenced.

Peaches and nectarines bear their fruit on wood of the past year's growth, the blossoms rising immediately from the bud, the same shoot seldom bearing again except on casual spurs. In pruning these the aim should be to secure a succession of yearling wood. If these suggestions are carried out, a great amount of thinning of fruits is avoided.

Apples and pears are entirely different to peaches, bearing their fruit upon small terminal and lateral spurs or short shoots which spring from branches of two or more years old. After the tree is once shaped, which is done very similarly to any other summer fruit, the annual pruning develops into merely cutting out cross branches or dead wood.

Cherries are produced upon small spurs on wood of two, three, or four years old, and the tree should be cut very sparingly during winter pruning. When limbs are to be removed it is better done in the summer, after the fruit is picked. This is also just as advisable with young cherry trees.

Plums bear fruit somewhat similarly to cherries, viz., upon spurs on two-year-old wood, and continue to bear upon them for many years, but, unlike cherries, should always be pruned in winter.

The apricot, again, is much like the plum, and should be very carefully pruned, especially until it is three or four years old. Endeavour to give every branch or limb a good hold on the main trunk and prevent the formation of forks, as the apricot is very liable to split.

Japanese plums require a modification of peach pruning, or rather a medium between the pruning of the peach and that of the plum, but, unlike the latter, they will stand a good amount of summer pruning in addition to the winter. They are rampant growers, and most prolific croppers, in fact have a tendency to overbear.

The olive does not require much pruning for the first two or three years, unless it be to remove all shoots which may start out on the trunk, and which are not so situated as to form part of the top of the tree. If the tree is of a bushy nature, it may be thinned out when

CULTIVATING ORCHARD AT WAGGA EXPERIMENT FARM.

THE accompanying illustration shows a 4-Horse Top Notch Cultivator at work at the Wagga Orchard. With this cultivator one man can easily cover from 12 to 14 acres per day, and this implement is of great assistance in stirring the soil up quickly after a rain. It does its best work, however, on fairly level ground, being so wide that if there are hollows and knolls only a few of the teeth will do their work while the balance are scraping the top, if indeed they touch it at all.

four years old, so that fruiting wood may be produced throughout the tree. The olive produces fruit on two-year-old wood only, and the tree should be pruned in the early spring, before it has started to grow.

When I speak of pruning in the winter I refer to deciduous trees only, citrus trees requiring all their foliage for protection in the colder climates, and consequently they should not be pruned until growth starts in the spring, when the cuts heal over quickly, and a good large limb can be cut off without any fear of the wood decaying. The object in pruning the young tree is to produce a well balanced tree, with sufficient strength to carry a full crop of good fruit, and with sufficient head to protect both tree and fruit from the effects of sunburn. The object also is to encourage a strong growth of wood, so that the tree may increase in size, with a good substantial stem or trunk, with branches so starting from the tree that they will be strong enough to hold a good crop of fruit—that is, each branch having a separate hold of the trunk of the tree, and not having the whole crown of the tree starting from one place, as is too often seen in our orchards, and in consequence, when the trees are heavily laden with fruit, the limbs split away. When one limb so splits, the others are so weakened that they easily separate, and in this way whole trees are frequently ruined. If trees are inclined to overbear, prune rather heavily the year before you expect the heavy crop. This lessens the crop, and, to a certain extent, acts as a thinning. I might say that, with very few exceptions, the fruit-trees of this Colony have been allowed to go with too little pruning, and consequently the limbs are long and willowy, and are not producing as good fruit as they would have done had they been well pruned.

As soon as pruning of deciduous trees is completed, spraying should also be pushed forward to completion as soon as possible, and at this season thorough spraying is easy of accomplishment, as there are no leaves or surplus branches in the way, and every part of the tree can be easily covered. This important work cannot be neglected.

The planting of deciduous trees should be finished as early in the month as possible, and all vacancies in old orchards should be filled up. Breakwinds should be planted around all orchards, and our public roads would be greatly improved by planting street trees at a distance of 15 feet from the fences on either side, and from 20 to 35 feet apart, according to the variety of tree planted. Peppers look very nice; plane trees do very well in some localities; *Grevillæ robustæ*, when they are not too much exposed to winds; sugar gums and eucalypti. The latter, however, are great robbers, and fruit trees cannot be planted at all close to them. There are certain pines which do well in the coastal districts, but in the hotter localities they are almost useless. Kurrajongs are rather slow growing, but they make a very nice breakwind, and do not rob the soil, consequently fruit trees will do well 20 feet away from them.

I would advise those who intend grafting any of their vines to better varieties not to prune them back until they are ready to work them, which operation is best to be done about the time the buds begin to swell in the spring.

Raspberry-growers should not neglect to cut out all the old canes and prune the bearing canes back wherever they are making strong growth, cutting off about a quarter of their length, and about the same proportion off of the side shoots. See that the land is well worked, and always remember that this fruit will do best on very rich land; therefore, if the land is poor, give it a good dressing of manure. Stable or sheep is the best.

Gooseberries should be well thinned out, leaving good new wood for fruiting. I find in many places that this bush receives little, if any, attention, in consequence of which gooseberries are imported every year from Tasmania.

I would like to again mention that the special resin wash which I have so often recommended has so far given the best results in destroying red scale. Wherever it has been used it has been most highly spoken of, and does exceedingly good work; but in spraying care must be taken to see that the work is done thoroughly, and so as to reach the inside as well as the outside of the tree, and the under as well as the upper sides of the leaves. Sufficient of the solution should be thrown on to each tree in the shape of the finest possible spray to cover every part. None, however, should be allowed to run to waste.

I might mention, in connection with winter spraying of deciduous trees, that salt, sulphur, and lime is the most effective and beneficial solution, and, if prepared in accordance with directions already given, will give every satisfaction.

It has been decided that the following prices will be charged for grape cuttings and fruit-tree scions, now obtainable at the Departmental orchards:—

Grape cuttings	2s. 6d.	for	25
	4s. 0d.	,,	50
	6s. 0d.	,,	100
	40s. 0d.	,,	1,000
Sultanas	10s. 0d.	,,	100
	80s. 0d.	,,	1,000
Assorted lots made up of 3 to 6 different kinds	3s. 6d.	,,	25
	6s. 0d.	,,	50
	9s. 0d.	,,	100
Scions	2s. 6d.	,,	12
	4s. 0d.	,,	30
	6s. 0d.	,,	50
Assorted scions	3s. 6d.	,,	12
	5s. 0d.	,,	30
	7s. 6d.	,,	50

Dormant Bud Oranges, excepting Paper Rind St. Michaels, are 2s. 6d. each, the latter being 3s. each.

All rooted vines to be 4d. each.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of July.

Vegetables.

Throughout the greater part of New South Wales the weather is likely to be extremely cold during this month, but in a few favoured localities on the northern coast, the effects of cold on vegetation will probably be but trifling if the plants suffer at all.

The heavy coastal rains in June saturated the soil and subsoil to such an extent that even if but few showers should fall during July, there will probably be sufficient moisture for all the vegetables that may be required.

Where there has been insufficient rainfall to justify the planting or sowing of vegetables, some land can be prepared for spring on the chance that rain may come in time for an early crop. A few of the vegetables easiest to produce might be tried at any time rain may fall in sufficient quantity to moisten the soil. A few radishes and some mustard and cress would be real blessings in many districts which are now passing through a terrible drought.

Probably, when the artesian bores become more plentiful, large quantities of vegetables will be obtainable where, at present, they are all but unknown, except as dried goods; still, well dried vegetables are by no means to be despised. When preparing for vegetables, trench at least 2 feet deep. Should a plough be used, take the precaution of using a subsoil plough after it.

Unless your garden soil be very rich, dig into and mix well with the soil abundance of cattle and horse dung. This manure, before use, should be well rotted in a heap or in a pit.

A ton of farmyard manure does not go very far when spread over the land (say), for instance, at the rate of 20 tons to the acre. This seems at first sight to be a prodigious quantity, but when spread over an acre it looks nothing at all. Just try a perch or two for curiosity. As I pointed out last month, a perch is just the 160th part of an acre, and it measures 16½ feet by 16½ feet. Put on to this plot the 160th part of 20 tons. There are 2,240 lb. weight in each ton; well, twenty times this gives 44,800, which, divided by 160 perches, shows that 280 lb. only is the quantity to apply.

To bring this down still lower, let us see how much dung, if applied at the rate of 20 tons to the acre, should be spread over each square yard. There are 30¼ square yards in each perch, and if this be divided into 280 it shows that as nearly as possible 6 lb. weight should be applied, or, say, a good-sized shovelful.

Just imagine applying farmyard manure at the rate of 1 ton to the acre, this would mean, as near as possible, 5 oz. to the square yard! At this rate you could possibly carry enough on a shovel for a perch of land.

All this shows that one is apt to misjudge proportions when so much weight to the acre is advised when dealing with areas much less than an acre in extent.

A ton of farmyard manure seems to be a very large quantity to the unitiated, but a little practical work soon shows that it will not go very far.

With the above simple assistance, or method of calculation which any public school boy or girl could manage, it is easy enough to determine the weight to be used on a small area, when following advice as to how much should be used per acre.

Asparagus.—The planting of this vegetable had better await until next month, or until the shoots are likely to start into growth. In the very cold upland parts of the Colony planting may be delayed even later.

Artichoke, Jerusalem.—Those who planted this vegetable last season should have an abundance of tubers wherever the season has been favourable. It is a good vegetable, nutritious, and useful for a change. The tubers should be dug up as they are required for use, for they keep sound better in the ground than anywhere else.

Small tubers may be planted now or later on towards the spring. Plant about 5 inches deep, 1 foot apart, in rows 3 to 4 feet apart.

Bean, French.—In the most tropical parts of the Colony a few seeds may be sown. In other districts it would be useless to attempt to grow it except under glass.

Bean, Broad.—Sow a few rows during the month. Plants from previous sowing should be growing well. This plant succeeds and produces best in stiff soils, but it will grow and bear to a certain extent on almost any kind of soil. Lime, gypsum, superphosphate of lime, and potash are good substances to use as manures.

Broccoli.—Sow seed largely of this useful kind of cauliflower, and, as soon as the seedlings are large enough, plant out to well enriched beds.

Cabbage.—Sow a few seeds in order to keep a stock of plants ready for transplanting.

Carrot.—Sow a little seed in drills about 1 foot to 18 inches apart. Thin out any plants which are coming up too thickly, and keep them free from weeds.

Cauliflower.—Sow a little seed. Plant out from seed-bed any that are well enough advanced.

Cucumber.—Seed may be sown in frames in a hot-bed if very early fruits are desired. In warm localities, where frosts do not occur, seed may be sown in the open garden, but some protection should be put over them at night.

Capscicums.—Plants may be raised under glass frames for planting out when frosts have passed.

Egg Plants.—These, too, may be treated in the same way as the above.

Leek.—Sow a little seed to keep up a supply of plants. Any strong young leeks that may be on hand should be planted out in well-manured trenches. Plant deep and do not allow the plants to become dry.

Onion.—Seed may be sown freely on well manured, well drained land. Sow in drills, the distance between which may vary from 8 inches to 1 foot or more, according to size of variety and also to the desire of grower to raise large or small specimens.

Parsnip.—Sow a little seed in drills.

Peas.—Sow largely in drills from 3 to 4 feet apart, according to the height the variety is likely to attain.

Savoy.—Sow a little seed in a seed-bed, and plant out any good plants you may have on hand.

Spinach.—Sow a little seed in drills 2 feet apart. Thin out to 1 foot apart when the seedlings are large enough to thin.

Swede.—Sow a little seed in drills.

Tomato.—Seed may be sown under the protection of frames, but frosts must be kept away from the plants when they come up.

Turnip.—Sow a little seed in drills.

Flower Garden.

During the cold frosty weather which is likely to occur during this month, flowers will probably be very scarce. However, wherever camellias will grow there should be some flowers; then, bulbs of some kinds will produce flowers. Fuchsias should be abundant, and some of the early daffodils are likely to blossom. A few of the ever-bearing roses continue to produce their flowers, and the sweet-scented daphne, violets, and mignonette fill the air with pleasant perfume.

All sorts of herbaceous plants, such as chrysanthemums, may be taken up, divided, and replanted, but before doing so, it would be an improvement to manure and dig up the whole garden. Roses may be planted, and also carnations, pinks, and dianthus of varieties. Phlox Drummondii, coreopsis of varieties, annual chrysanthemums, campanulas, foxglove, cowslip, daisy, penstemons of variety, polyanthus, scabious, verbena, wallflower, lobelias, lupins, and various other interesting plants.

Seeds of tender annuals should be sown under frames in some warm place, so that the plants may be available in the spring for planting out when all fear of frosts is over. Amongst these are the various kinds of amaranthus, or the cockscomb family. Some of them are valued for their peculiar flowers, and others for the beautiful foliage of their leaves. Roses may be planted also. The rose is undoubtedly one of the most satisfactory garden plants to grow. Some varieties, especially of the tea class, are almost continuously in flower.

Towards the end of the month the planting of all kinds of deciduous plants should be completed; all hardy annuals and perennials should be in their places, and many of them should be in blossom.

General Notes.

Late Tomatoes.

Mr. V. D. Paterson, of Summer Hill, writes: "A friend of mine and I have each tried an experiment with tomato-plants, which, I think, will interest your readers. Towards the end of the season, when the plants were about done to all appearance, we cut them down to the ground, and gave them a good dressing of manure and plenty water. In a very short while they sprouted, and became fine plants, and we have had a plentiful supply of late fruit in consequence.

"With some other plants which I have at present I purpose similar treatment, and by this means hope to get very early fruit, as, owing to the extra trouble involved in forcing the plants in a hotbed, &c., I think this plan will be much simpler and just as effectual.

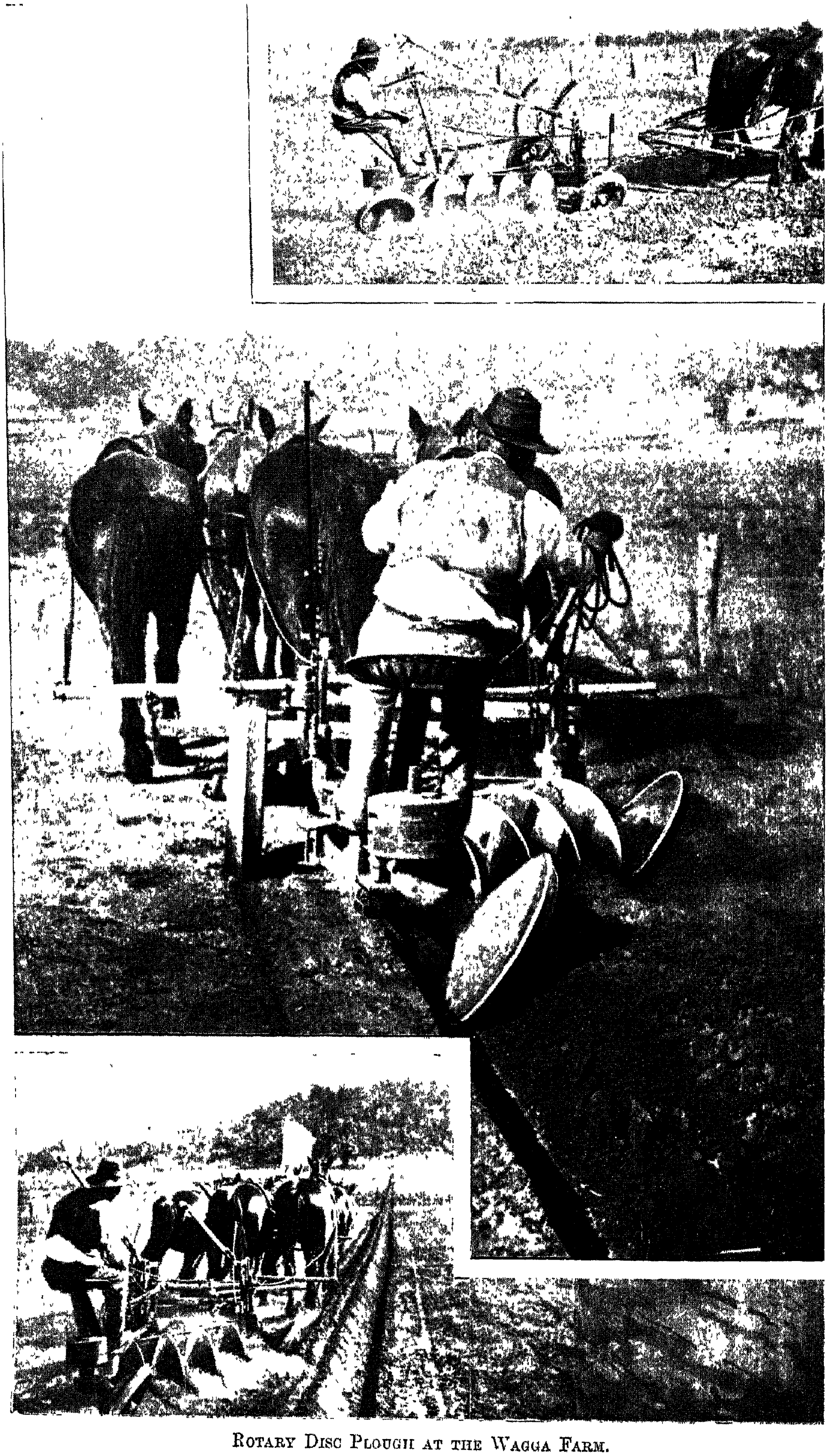
"The plants mentioned in my first paragraph are still bearing, and appear likely to continue all the winter, and, as the frosts are never severe about Sydney, I think, by adopting a method somewhat similar to that described, it would be possible to have a very fair supply of fruit all the year round.

"If it is found that the tomatoes do not ripen well in the middle of winter, they can be easily utilised for green pickle, as per recipe to be found in the *Farmers' Guide.*"

The Rotary-disc Plough.

Some months ago a description of the Spalding-Robbins Rotary-disc Plough was given in the *Gazette* by Mr. J. L. Thompson, Travelling Instructor in Agriculture, who also brought under notice the opinions expressed by a number of colonial agriculturists as to the effectiveness of the implement.

In January, 1898, a four-disc plough of this make was obtained for the Wagga Wagga Experiment Farm. From January up to the end of the season it was used in stubble land of the ordinary Riverina type with very successful results, an excellent seed bed having been formed in paddocks which in many places could hardly be broken up by the ordinary mould-board ploughs at the farm. In order to determine the respective merits of the work performed by the disc plough as compared with those of the mould-board type, parallel portions were operated upon, and it was found by Mr. McKeown, the manager, that the sections worked with the mould-boards required to be twice harrowed and rolled with a heavy spiked roller to produce a similar condition of the soil to that worked by the disc plough. The soil was also broken 1 inch to 1½ inch deeper by the discs, and the



Rotary Disc Plough at the Wagga Farm.

greater portion of it was ready for sowing without any further preparation. The wear of the discs was about half an inch for nearly 300 acres last season (1898), and after having ploughed a further 250 acres this season with new discs, the running gear is in good condition.

With labour at 6s. per day of eight hours, and full rates allowed for horse-feed, two men with four-disc ploughs, with five horses in each, have recently completed a paddock of 183 acres at a cost of 2s. 8d. per acre, or, with a liberal allowance for interest and wear and tear, less than 3s. per acre. A second paddock of 155 acres, with shorter lands, cost 3s. 1d. per acre for ploughing. The seed-bed formed in 75 per cent. of this land was in excellent condition, fit for sowing broadcast or with the drill. The remainder, owing to it having been worked while damp the previous season, required some further treatment. The depth of the ploughing was 5½ to 6 inches.

Long stubble has been thoroughly covered, but some of the shorter stuff is apt to lie on the surface.

In the opinion of all who have tried the disc ploughs during the past couple of seasons, when the ground has been exceptionally hard and dry, it is considered as much work can be done with one six-furrow disc plough, one man, and six horses, as with three double-furrow mouldboard ploughs; a saving of two men, and, in hard ground, at least six horses.

With a view to having these ploughs tested as widely as possible, the Minister for Agriculture (Mr. Cook) has decided to offer several as prizes in the farming sections at some of the Agricultural Shows in districts where the introduction of such implements would prove of greatest benefit.

In the accompanying illustrations the disc-ploughs in use at the Wagga Farm are shown.

Coffee-husking in London.

The following circular addressed by Messrs. Major and Field to their agents in Jamaica may be of interest to growers of coffee in the North Coast districts of this Colony. It is needless to say that if the growers, while the output of berries is of limited quantity, can ship the produce in a comparatively raw condition for treatment in a wholesale and naturally cheaper way in London, the industry will stand a better chance of getting well established than if each grower endeavours to carry out the various processes at his plantation.

"Having been the first to erect machinery for husking coffee in London, and being frequently asked for a few particulars as to the treatment of the parchment, we venture to submit the following remarks to those of your friends who are interested in the question. At the outset we would mention, that the operation is chiefly applicable to coffee treated by what is called in some countries the 'West India preparation,' *i.e.*, to 'washed' coffees, which are known by the trade here as 'colour.' As these descriptions are most sought after by buyers, and command far higher prices than the qualities known as "unwashed," it is obvious that planters, in their own interests, should

endeavour to market their crops in the former condition, the difference in price in a normal market being fully 20s. to 25s. per cwt. in its favour.

"To obtain the best results, it is necessary that each operation, commencing with the gathering of the crop, should be performed with great care and discrimination. Only cherries of uniform ripeness should be plucked, as otherwise the pulping and most of the subsequent operations will be made difficult to perform, and the cleansed coffee will lack that uniformity of appearance and colour which is so highly prized by the buyers. The cherry coffee should be passed through the pulper (the machine for removing the pulp from the berries) as soon as possible after it is gathered, as the pulp is more easily removed before it has had sufficient time to dry and shrivel; care must be taken to see that the cherry pulp is thoroughly peeled from the berries, and as several of the latter will escape the action of the pulpers, sieves of a size which will allow only the free parchment coffee to pass through must be used, so that the cherries remaining in the sieves may be returned to the pulping machine. After pulping, the parchment coffee has to undergo a process of fermentation, and subsequently of washing in suitable tanks, when the adhering saccharine matter is got rid of; during this latter operation it is of great importance that the parchment should be constantly stirred about, as by this means the light, black, and imperfect beans rise to the surface of the water, as well as sticks, leaves, and such like impurities, which should be skimmed off and treated separately. At no subsequent stage can this important object be attained in anything like so cheap and effective a manner, as the inferior beans can only afterwards be separated by hand-picking, a tedious and costly operation.

"After washing, the parchment coffee has to be thoroughly dried, an operation requiring perhaps more knowledge of the article than any other, as on the way it is carried out depends to a very great extent the subsequent market value of the crop. If not sufficiently dried, the parchment often becomes more or less musty in transit and the colour deteriorates, thus seriously affecting its selling value; and from the fact that the outer layer of coffee in the bags dries on the voyage to a greater extent than the bulk in the centre, it is difficult, and sometimes impossible, for us when we dry it here before husking to obtain an even result. In addition to this, freight and charges have to be paid on extra weight, which is an absolute loss. We may mention that many parcels we have received in a damp state have lost over 20 per cent. after drying, exclusive of the loss in weight naturally caused by the removal of the parchment. It will thus be understood that it is imperative the parchment should be properly dried, especially as extra charges are incurred for drying here. On the other hand, care must be taken not to over-dry the coffee, as otherwise the colour will be impaired to some extent, which will reduce the market value. It is therefore apparent that the greatest care and experience is required to ascertain when the parchment is in really prime condition. In order to do this the parchment must be removed from a few beans, representing an average of the bulk, as it is not sufficient for the former to appear dry and brittle, as the bean inside naturally takes

much longer to lose its moisture. After drying, coffee intended for husking in London has only to be shipped without further loss of time.

The advantages to be derived by planters in forwarding their coffee in parchment are several. The parchment covering acts as a great protection to the bean, while in transit, from all the deleterious influences to which it is necessarily subjected while in the close hold of steamers, on quays, &c., and above all it preserves the colour. This is probably one of the greatest advantages of any—as the finer the colour of the coffee the higher is the price paid by buyers—and it has been abundantly proved that coffee husked here fetches prices higher by several shillings a hundredweight than the same coffee when cleaned abroad. Planters are also enabled to market their crop, probably several weeks earlier than if they have to wait to husk it themselves, which is a matter of very great importance, as it often means selling before the bulk of the crop arrives, instead of when the market is glutted, which usually results in lower prices, at least for a time. A material saving of labour is affected in districts where it is scarce, or where the crop is a heavy one, at a time when it is extremely important all hands should be concentrated on harvesting; and, when this is complete, on the more careful cultivation of the plantation, thus increasing its powers of production, and at the same time getting the husking of the coffee done as cheaply as it could be effected on the estate. The outlay on machinery and other incidental expenses would be saved, and capital that would be locked up is set free. Further, the dangers of a breakdown are avoided—a very serious matter on estates, where every important piece of machinery has to be obtained some thousands of miles away. Receiving as we do many thousand bags of parchment coffee each year, we have necessarily obtained considerable experience in the manipulation, and we are enabled to work each parcel in the way best calculated to meet the requirements of the trade in all its different variations.

The total cost of receiving from import ship, landing, husking, sizing, and all the usual operations is 2s. 6d. per cwt., which we believe is at least as cheap as it can ordinarily be performed by planters, if not cheaper, including, as it does, the charges that would be incurred here on the coffee if it had been husked before being shipped. The charge for drying is extra, and depends entirely on the condition of the parcel; but from what we have already stated, it is a charge which, in their own interests, planters should never incur here. The loss in weight from husking varies largely according to the nature of the parchment, and ranges from about 15 per cent. up to, in a few exceptional cases, about 22 per cent.

We have occasionally received parcels of coffee, dried in the cherry, to husk; but we cannot recommend this mode of shipment, though it is possible that in a few individual cases planters might find it desirable to adopt it. In the first place, it adds unduly to the charge for freight, the coffee never turns out of such fine colour as it does if prepared as already detailed, and, of course, the loss in weight after removal of the cherry and parchment covering is much heavier;

besides, it is much more difficult to work, and necessitates a charge of at least 3s. 9d. per cwt.

The best mode of packing under ordinary conditions is in stout single hessian or gunny bags, of either 2 or 3 lb. tare, the bags to contain about 104 lb. net of parchment coffee, a suitable measurement for such bags being 36 inches wide. Under some circumstances it may, however, be necessary to fill the bags into a heavier or lighter weight in order to meet special transport requirements. It should be borne in mind that in London the tare is ascertained to the pound only, so that makers should be instructed to supply bags weighing a few ounces under the required tare. For instance, if a 2 lb. tare is wanted, the bag should weigh from 1 lb. 12 oz. to 1 lb. 14 oz., as some margin must be left to meet possible variations in material and any slight increase in weight on the voyage.

The foregoing remarks apply principally to coffee of the species Arabica. As regards Liberian coffee, we have no hesitation in advising that, unless absolutely compelled, shipments should not be made in cherry, as in this condition the coffee is very difficult to work. Even this species may, howerer, we believe, be shipped in parchment with advantage; and information on this point, and the cost, &c., we can readily supply if you should be interested in the question.

That the business has developed so largely since we commenced operations in 1884, appears to us conclusive proof that many planters are fully alive to the benefits to be derived by the adoption of this method for marketing their crops; and we therefore trust these remarks may be of special interest to those who are at present unaware of the facilities to be now obtained in London, and who have not suitable machinery on their estates for cleaning the coffee themselves.

Treatment of Seed-wheat for Smut.

Mr. John Stinson, of Moorland, writes: "I have noticed in the *Agricultural Gazette* recipes for the treatment of seed-wheat as a preventive of smut. I have a recipe, received by my father from a friend in America over fifty years ago as a treatment much in vogue there at that time. He used it for many years, and was considered a fairly successful wheat-grower upon the Lower Hunter River in the forties and fifties, when I believe good samples of wheat were produced there. I enclose a copy, and if you think it worth while you are at liberty to publish it."

Recipe for Treatment of Seed-wheat to prevent Smut.

Take a cask of sufficient size (for three bushels about 40 gals. will be required); bore a hole in bottom near the side; fit a plug on inside, reaching to top of cask, to be easy of withdrawal. Place on bench or block sufficiently high to allow a tub under. Dissolve 2 oz. bluestone for each bushel to be treated at that time. Add sufficient water to cover the wheat. When in the cask, pour the wheat steadily into

the solution, so as to allow light grains, &c., to float and be skimmed off. Then let it soak eight hours, when withdraw the plug and drain solution into a tub, when the wheat may either be dried with lime or ashes, &c., or sown wet. For future use, the same solution may be used, and by adding the amount of water required and 1 oz. of bluestone per bushel, the requisite strength will be obtained. In the size of cask and quantity of water, due allowance must be made for the wheat swelling, so that it may be covered. The hole in the cask need not exceed ½ or ⅝ inch, as a larger hole allows the seed to run through. This preparation is said not to injure the wheat germs in the least, but to cause it to sprout quicker. Neither is the seed poisonous, as fowls have been known to eat quantities of it without showing any ill effects.—Ontario, Canada, June, 1845.

Concerning the above, the Wheat Experimentalist, Mr. Farrer, says—"This appears to be a good recipe for the treatment of seed-wheat for bunt, although it is in some respects defective. Details in it which are of special value are:—(1) Pouring the wheat gradually into the solution, so as to cause the bunt balls, chaff, light grains, &c., to be left floating on the surface. I would suggest that the skimming off of these foreign matters should be done at frequent intervals. Another valuable point in the recipe is (2) the using of wood-ashes (they should be as fresh as possible) for drying the wheat. I have often thought that it might be possible to make this substitution, because wood-ashes consist so largely of lime. This substitution would be advantageous, because wood-ashes can generally be had so easily in the bush and cost nothing, while lime is often hard to get and expensive. I may here point out that it is not its drying effect alone which makes the treatment with lime of wheat which has been made wet with bluestone-solution to be valuable, but some other action (probably chemical) of the lime on the spores of the bunt. At any rate, treatment with bluestone-solution alone comes short of being entirely satisfactory, and is only really effectual if it is followed by treatment with lime or (probably) with fresh wood-ashes."

Apple-trees subject to Blight.

A fruit-grower in the New England District reports that he obtained from Tasmania 100 Sturmer Pippin apple-trees, supposed to be blight-proof, but which are now so infested with woolly aphis as to be worthless. He wonders whether the climate can have had anything to do with it.

The Fruit Expert, Mr. Allen, is of opinion that for apples, cherries, gooseberries, pears, currants, and other English fruits, nowhere could be more suitable than the better-class soils of New England at about 4,000 feet above sea-level. As far as the outbreak of blight in the trees under notice is concerned, it is quite evident that they had been simply worked on common apple stock. Every care should be taken to secure apple-trees worked on blight-proof stocks from absolutely reliable sources.

Catch Crops.

A good succession of catch crops to sow between the regular crops is as essential to good farming as the selection of the main crops. It is often the neglect of these that makes farming so haphazard and uncertain. On old lands the catch crops are particularly important in keeping up the fertility of the soil to a proper standard. There are plenty of farmers who rarely give much attention to catch crops, but it is due to carelessness more than to any well-considered conclusion drawn from experience.

The more catch crops that we can sandwich in between the regular crops in the course of the summer the better will the condition of the soil be another season. These crops add to the soil the green fertilising material that most lands need, and the more exhausting a crop is to the soil the more essential is it that the green plants should be ploughed under every season. By paying proper attention to the catch crops we reduce our manure bill, and save work at other seasons of the year. It is really like killing two birds with one stone.

The leguminous crops are the best for catch crops on most soils, especially where clover will not make a good stand. Beginning early in the season—that is, about the end of August, when the corn is planted—the soja beans make an excellent catch crop. Either the dwarf or medium variety will do for this purpose. They should be sown first of all the catch crops, because they will thrive when the ground is too cold and wet for most of our other catch crops. Cowpeas are excellent for sowing in the beginning of September, when the ground is warm.

Canada field-peas or crimson clover should also be used for a catch crop during midsummer. Both plants furnish plenty of green for the soil. In many places rape may be sown in preference to either; and if the weather is good, a large crop of green food will be supplied for autumn use. Buckwheat is another good spring catch crop that can be used on some soils to great advantage. Rye is the best late crop, and it can be sown any time almost in autumn and winter. By preparing the ground in time for these catch crops, a perfect succession of them can be had at all seasons. As a rule, the leguminous plants are preferable to the others as catch crops. Most of the above belong to this class.—W. E. Farmer.

The Seed-bed.

The great problem in all soil culture is to prepare the seed-bed so that it will hold just the right amount of moisture to best promote plant growth and to conserve the excess of rainfall in early spring against the period of drought which comes almost every summer. If scientific and practical agriculturists have demonstrated anything during the last twenty-five years it is that this condition can best be attained by the careful and thorough preparation of the seed-bed. Good ploughing and harrowing and dragging until all clods have been reduced is absolutely

necessary. Because this is true, the scratching in of oats with a cultivator, and the late broadcasting of wheat and covering lightly with a harrow, so common in many districts, are reprehensible practices, and to them can be charged many a short crop and many a discouraged farmer. Only a comparatively small amount of additional labour will suffice to correct this, and the success or failure of many a crop is determined by the observance or neglect of this factor exchange.

The Real Value of Crop Rotation.

"A bare soil, writes Mr. G. W. McCluer in the *American Agriculturist*, must sooner or later become a barren soil, even without the removal of crops. This comes as a result of the gradual loss of decaying vegetable matter, humus, the more rapid washing of the bare than of a covered soil, the loss of proper mechanical condition which comes from the loss of vegetable matter and the beating rains and the lessened power to take and hold water. Water is not usually looked upon as a plant food; but so far as the plant needs it, it is as much food as is nitrogen or potash or phosphoric acid. No matter how rich a soil may be in everything else, if there is no water there is no growth.

"It is not so much a question of the crop, and what it individually takes from the soil, as it is of the kind of cultivation which it seems necessary to give to the soil while the crop is growing. The crop takes so little comparatively from the soil that it alone can hardly make the difference that comes so rapidly. I have several places on my farm that seem practically barren from improper handling. When this barren soil and clay have washed down on to lower land and spread out it has made my most productive land. The mechanical condition has been so improved in the drift that it holds water better, and the roots penetrate it better where it is than where it was.

"There seem to be some things in the farm practice that are opposed to each other, and it must be a question for the farmer to decide when to do the one thing and when the other. Thorough cultivation tends to preserve moisture, but the added air and moisture which a loose soil will hold, hasten the decay and loss of its vegetable matter and in turn render it less capable of receiving and holding moisture. Plants having plenty of room grow better and produce better than those that are crowded; but to give them all the room that is desirable means much bare earth and comparatively little winter protection or vegetable matter to return to the soil after the crop is gathered.

"It seems to me that this forms the real reason for the benefit that comes from a rotation of cultivated with non-cultivated crops, and this has come to be the basis of all the rotations. The teachers of agriculture used to say alternate root crops with grain crops, and crops with broad leaves with those having narrow leaves; but there seems to have been really little reason for the advice. The main thing to be sought in all our cropping is to keep the land as fully occupied as it is possible to do."

Collecting Seeds of Native Grasses.

There can be no doubt that the greatest drawback to more extensive cultivation of the best of our native grasses, is the difficulty experienced by seedsmen and farmers in getting supplies of reliable seed.

The prolonged drought has attracted attention to this subject, and for the guidance of those who desire to collect seed, Mr. Geo. Valder, Principal of the Hawkesbury College, has furnished the following information :—

"From time to time some thousands of packets of so-called native grass seeds have been sent to me for trial, and the contents of the majority of these packets have been worthless. Often the packets contained heads of grasses in which the seed had not matured (were in fact just flowering), and in other cases packets of empty glumes were sent—*i.e.*, heads from which the seed had shelled out. Other packets contained seeds or flower heads of plants which somewhat resembled grasses, such as sedges, but which were useless for cultivation. In all cases collectors should first send in specimens of grasses when they are in flower, to the Department, so that they may be identified and information be given as to their feeding value, &c. If the seed heads of the grasses are carefully examined before collecting, with a little practice, the collector would be able to tell whether the seed is ripe or not.

"It is useless collecting until the plants are beginning to shed their seed, as the seed should be quite ripe. It is advisable to expose the seed in trays or on paper to the air for a few days until they are quite dry, then pack away in bags. If you do not know the name of the grass you are collecting, put a few heads into the bag with the seed for future identification.

"Some grasses mature only a small percentage of seed. With kangaroo grass, for instance, great care is necessary in collecting, as even apparently fertile seed often germinates badly. Result of experiments at College in this direction :—First year, 7 per cent. germinated; second year, only 3 per cent."

What are Fungi?

At the present time perhaps, the most serious enemies of the tillers of the soil are found among the fungi. A fungus is a plant which is destitute of the green colouring matter of the higher plants, and as this green colouring matter, or chlorophyll, is the only substance known through which the plant changes its crude food material to nutritive material, it is evident that fungi must feed upon organic material which has been previously elaborated by the host plant so as to be adapted to their wants.

That portion of a fungus which causes the damage to the host plant is composed of long, fine threads, known as hyphae, which occur either separately or in bundles. Taken together they form the vegetative portion, or mycelium, of the fungus. The mycelium corresponds to the roots and stems of the flowering plants. Spores are organs which are produced upon the mycelium, either upon the main body,

or upon branches thrown out for this purpose. These spores take the place of seeds in the higher plants, although, strictly speaking, they are not seeds, as a seed contains a young plant, while a spore, being usually composed of one cell, does not. Given the proper conditions of heat and moisture, the spore will send out a fine filament, which, if in reach of proper nourishment, will develop, and, eventually, a plant similar to the original will be produced.

There are two kinds of spores which are usually produced by the fungi in this latitude, known as the summer and winter spores. The summer spores are commonly borne upon the surface of the host plant. These spores ripen quickly and reproduce the fungus with great rapidity, but they soon lose their vitality if the proper conditions for germination are not given within a short time after maturity. The winter spores are usually produced within the tissues of the host plant, commonly in the fruit and leaves. They live through the winter, and in the spring, if given the proper conditions for growth, germinate, and the fungus is again developed.

As the fungus is developed within the host plant, it becomes evident that after having once become established, all remedies are useless so far as that generation of the fungus is concerned, as it is impossible to reach the interior of the plant. Therefore, in the treatment of these diseases, we must look for a vulnerable spot in their life cycle. This spot is generally found in the spore, before or at the time of germination. In the treatment of all fungous diseases the remedies must be largely preventive rather than curative.—Messrs. Tillinghast & Adams, Rhode Island Experiment Station, U.S.A.

Navels without a Rival.

The following appeared in the *California Fruitgrower* of a month back, and shows in what light the New South Wales shipments of fruit to London are regarded in California:—

"Speaking of the California seedless, or navel orange, the *British Fruitgrower* asks, 'Has it a rival?' and answers its question as follows:—With regard to the permanent nature of the position this orange has taken up in the English markets, it is as well to inquire if it has anything like a rival to contend with? And the reply is—no. In the first place, the only fruit that approaches it is the Jaffa, and that fruit, though very fine, has certainly degenerated of late years, and the specimens now on sale are nothing like what they used to be. The latest arrivals of navels completely supersede it, without doubt. Then there are the fine fruits from New South Wales. Well, unless the shippers of these fruits can put upon the market something better and bigger than they sent us last year, they will be out of the running as against the seedless fruits from California. That is clear. I admit that the shipments of the former were in some cases remarkably fine, the colour was high, and the flesh of the fruit juicy and good; but size for size, weight for weight, colour for colour, they were superseded by the navels easily.

"I am not passing a hasty opinion in this matter. I inspected the oranges from New South Wales, on the personal order of Sir Saul

Samuel, at the wharf. I had several of the boxes opened, and I carefully noted the size, appearance, and quality of the fruit, so that my opinion is based upon good grounds. I even predicted the day before the sale that the fruit would make from 12s. 6d. to 22s. 6d. per box of fruits holding from 160 to 200 oranges, and my estimate was almost exactly verified, although the sale was the first of its kind in London. It is thus clear that there is a great future before the seedless oranges in the United Kingdom."

Protecting Seed against Birds.

"I wish to let the farmers know a certain and cheap preventive of the sparrow and cockatoo pest at sowing time," a Bridgewater correspondent writes. "It is to first wet the seed, by dipping a bushel or two at a time, contained in a bag, in a tub of water. Allow the grain to remain in the water for a few minutes, so as to get throughly wet. Then lift the grain and empty it on a clean floor. When the required amount of grain is wet in this manner, dry it with superphosphate. The seed is now ready for sowing, and I will guarantee no birds will eat it or pull it up. This also has the further advantage that it manures the seed in a very economical and efficient manner. The manuring of the seed in this way will give it a good start. Should it be desired, the grain may be pickled with bluestone, by dissolving it in the water used to wet the grain, and it will then prevent smut in the crops."—Oxley, Fairfield Park, in *Melbourne Leader*.

Departmental Orchards.

A Fruit-grower at Beecroft suggests the establishment of an experimental orchard, somewhere in the centre of the County of Cumberland, where all kinds of fruit, suitable for the peculiar requirements of the district, might be grown and tested. Among other things, he thinks special attention should be devoted to the nomenclature of the varieties and the place should be open at all times for inspection. "Wood should be supplied, for budding or grafting purposes, to all who wish to take it, except nurserymen. Then, there might be a canning and preserving and perhaps also a drying plant connected with the orchard, to which people who had not enough fruit, to warrant the purchase of the necessary preserving appliances, could take their produce to be treated at a reasonable cost." "Of course," he adds, I can see that this affair might grow into something very large, but I think, if it where profitable, private enterpise would come in and so relieve the State to a great extent."

As to whether the establishment of a State orchard in the central portion of the County of Cumberland would be desirable or not, it is beyond the province of the *Gazette* to say; but as Mr. Allen, Fruit Expert to the Department, points out, although the Hawkesbury Agricultural College orchard is not in the centre of the Cumberland district, it is quite within the reach of, and always accessible to, all who wish to pay it a visit, and any information which may be required about fruit-culture can be at all times obtained. The officer-in-charge will also

gladly furnish information as to the best methods to adopt in drying, canning, and jamming fruits, but of course the Department cannot embark in the canning industry in a more extensive scale than is necessary to demonstrate the commercial utility of the methods advocated.

At present, the Department is importing the best varieties of citrus stocks as well as new and approved varieties of deciduous fruits, and as they become available scions will be supplied to growers at a reasonable cost.

The same is being done at the other Departmental orchards, and the Fruit Expert and his staff are most anxious to bring under the notice of all interested in fruit-culture everything that is calculated to be of service in advancing the industry, by the production of fruit of the highest quality and the adoption of the best methods of turning it to profitable account.

The Benefit of Early Ploughing for Wheat.

Mr. J. J. Piper, of Tamworth, writes: "In the May issue of the *Agricultural Gazette*, Mr. Feilen and Mr. Worboys speak of the benefit of early ploughing for the wheat crops. I have an instance in confirmation of this. Twelve months ago last harvest, during some damp days when we could not get on with the harvesting, I put some of the men ploughing some of the wheat land from which the crop had just been removed. Between the land then ploughed a strip a chain wide was left unploughed. Sometime in the following March this land was ploughed again, together with the strip of land that was not ploughed at the first ploughing. When harvest came that land that had the first and early ploughing had wheat on it 3 feet high, which yielded about 25 bushels per acre, while on the strip that had only the one and late ploughing the wheat was only from 12 to 18 inches high, and the yield about 4 bushels per acre. The wheat on the strip that had received but one ploughing was so much shorter than the crop on either side that it looked almost like a road through the crop."

Fumigation for Scale Insects.

The fumigation process for the eradication of fruit pests has met with considerable success in other countries, and it is found to be more economical and effective in many cases than spraying.

It may be explained that fumigation for the destruction of insect pests means enclosing the trees in an air-tight tent, in which is generated enough poisonous gas to fill the whole space, and destroy all insect life. The gas now used is hydrocyanic acid gas, which is generated by placing 1 oz. of sulphuric acid in 3 oz. of water in an earthenware dish. After placing the tent over the tree to be treated, the dish is placed under the tree, the edge of the tent lifted up, and 1 oz. of cyanide of potassium dropped into the dish with a long-handled shovel, the flaps dropped at once, and the edges of the tent kept down with some earth thrown upon them, and the tree is left under the tent from twenty minutes to half an hour, according to size. The above

formula is sufficient for 150 cubic feet of space, so that for every 150 cubic feet another ounce of each chemical and 3 oz. of water must be added. All the chemicals used and the gas generated are poisonous, so that great care must be taken not to inhale it when treating the trees, but with ordinary care there is very little danger to the operator, and the fumes quickly disperse.

With a view to giving local orchardists an opportunity of acquiring a knowledge of this method of treating insect pests, Mr. Cook, the Minister for Agriculture, recently instructed the Government Entomologist to obtain the necessary appliances, and carry out experiments with the process in this Colony; and on the 19th Mr. Froggatt visited Kenthurst and fumigated trees infested with red and olive scales, in the presence of a number of local orchardists, who were much interested in the work. The process was entirely successful, examination of the trees after treatment showing that the olive scales were all dead, and all the larvæ and small moving red scales were also destroyed. This method of testing insect pests is both economical and effective; and in next issue there will be an article by the Fruit Expert illustrating and describing the method of fumigating citrus trees at the Departmental and other orchards.

White Spots on Passion-fruit.

Mr. A. F. T. Somerville, of Kurrajong Heights, mentions, that nearly all the passion-fruit in his district is affected to some extent by a little white spot.

Mr. W. J. Allen, Fruit Expert, reports, that the spots are due to a fungus disease, which may be kept in check by spraying occasionally—when the fruit is small—with Bordeaux mixture, and later with ammonia-carbonate of copper. The vines should be pruned well back once a year and receive in all three or four sprayings. Such treatment will entirely prevent the appearance of the disease.

Cooking Food for Poultry.

On this very moot point Mr. Edward Brown, writing in the *English Agricultural Gazette*, says: "For some classes of stock it is generally admitted that the cooking, either wholly or partially, of the food is of very doubtful advantage, but experience has shown that for fowls kept under domestication this system is to be recommended. It must be borne in mind that when poultry are prevented from obtaining those forms of natural food which seem so desirable, and at the same time by reason of their conditions, do not obtain the exercise which is necessary to enable them to digest the harder grains and meals, then we do not utilise all the elements contained in the food unless it is prepared so as to be easily digested. This question involves many considerations, but there can be no doubt that if the food is properly softened or cooked we can use forms that would not be adaptable to our fowls in the raw state.

"It is necessary to remember that grains and meals are not the natural food of poultry. When in their wild state birds obtain forms of food which are unavailable under domestication. Most of these

forms contain a considerable amount of moisture, and are easily digested. Hence the nature of the fowl is not to utilise the harder materials which are supplied to them, at any rate to the fullest extent. It is for this reason that the practice of giving soft food has come so largely into vogue, and there can be little doubt that the doing so very greatly stimulates egg production. Some time ago a series of experiments were carried out at the New York Agricultural Experiment Station as to the feeding upon moistened meals as compared with dry grains. It was shown that two lots of laying hens, of larger and smaller breeds respectively, having their grain fed only dry and whole, ate more food, at greater cost per fowl, and for the live weight, than did two similar lots having about 37 per cent. of their grain ground and moistened. Further, that a pen of fowls which had over a period of twelve months 37 per cent. of their food ground and moistened, produced eggs at a greater profit than did an exactly similar pen to which whole grain only was fed. This is a very important point, and emphasises strongly the recommendations, which have been made as to the use of soft food.

"Accepting the principle here laid down, it is necessary to consider how the food should be prepared, and there can be little doubt that the cooking makes it more easily assimilated than if it is simply mixed with water. Moreover, a greater variety can be given, and it is well to remember that for birds under domestication, either producing eggs or frame to a greater extent than would be the case under ordinary conditions, we must supply the materials so that they will tax the system as little as possible. The plan of mixing meals with cold water is most objectionable, for as Professor Warington, in his "Chemistry of the Farm," points out, the feeding of foods rich in water is often diminished by the fact of heat they produce in the body being consumed in raising the water to the temperature of the animal, and vapourising a part of it as perspiration. Meals should always be mixed with hot water, but with certain classes of foods this is not enough. It may be mentioned that clover-hay is a very valuable article of food, but would be useless in the dry form. When cooked and mixed with meals it is an addition to the rations of our poultry which during the winter season cannot be over-estimated. Potatoes also cannot be fed dry. Some forms of roots are equally objectionable unless cooked, and, moreover, by cooking we can blend the constituent elements together to give as near a perfect ration as is possible. All these facts are recognised with larger stock, and it is desirable that we shall realise the importance so far as poultry are concerned, to which species the principles laid down for other animals are equally to be applied.

In many places the difficulty of cooking the morning meal is very great, and the reason why this system has not been adopted more fully is largely owing to this. It is a very wise recommendation that birds shall be fed as early in the morning as possible. To do so, if the food is to be cooked, means getting up at a very early hour, and thus the advantage of the cooking is to a large extent lost if the birds have to wait too long for their morning feed. I have been using of

late a very excellent appliance, which has been exhibited at several "Royal" and other shows, Parrish's Steam Jacketed Cooker.

The plan adopted is to mix the food in the evening, place it in the food vessel and light the furnace. It is then allowed to burn through the night, and, as it is slow combustion, the fire will last several hours. In the morning, although the fire was burnt out, at the same time the food is not only thoroughly cooked, but is in a warm condition, much better than if it were very hot. There is no doubt whatever that the fowls appreciate the food so prepared, and, as already stated, various things can be utilised that would otherwise have to be thrown away. Of course, the mixing requires some consideration, and it is necessary to avoid making it too rich, but this can be done. We have only to name that one useful material which can scarcely be given to the fowls, because it does not remain long enough in the system to be thoroughly digested, is bran; and yet, when mixed with certain classes of food, bran is very valuable. Hence it is not at all difficult to balance the ration so that we feed it as near perfection as possible.

The value of vegetable food is very great, and experience has shown how important it is to see that birds have a proper supply; but in the winter season especially this is either deficient or not in a state to be easily digested, and, as Professor Warington points out, birds have apparently no power to digest vegetable fibre, as the food passes too quickly through the system for the fibre to be properly attacked. When, however, the food is cooked this difficulty is entirely overcome, and that which would be comparatively useless becomes of considerable value for the feeding of our poultry.

How to Set a Plough.

I have been asked to write a few notes upon the above subject, and as the person making the request did not mention the type of plough he wished me to write upon, my remarks must of necessity be of a general character. The great diversity amongst ploughs prohibits a detailed account of each, even if I felt competent to deal with them, they ranging from the Planet Junior, pushed by hand, to the larger multiple and disc ploughs drawn by horses, as well as to the larger implements used in steam cultivation. The following remarks are not intended to instruct the ploughman, but rather the tyro who has but lately taken to the cultivation of the soil. To the former they would prove superfluous, but to the latter a few hints should prove very acceptable. Nothing is more annoying than to get hold of a pair of coltish horses, which have had a few month's spell, hooked to a single furrow plough, with a rusty mould-board, to plough up a few acres of clayey land in the spring; and, if the operator is a new chum, he will experience some difficulty in driving the horses and holding the handles at the same time; the furrow will be crooked, the horses fretted, the mould-board shockingly dirty, the weeds clinging to the coulter, and the driver may not be patient. In such a case the necessity of keeping the plough under cover when not in use and the board well greased would be apparent.

Also, instead of hooking the bars up short to the head of the plough, a couple of feet of chain be used, less trouble will be experienced in keeping the plough to its work, instead of its following too closely the irregular path of the horses. Such a chain proves very effective on many ploughs, especially in hard ground, but if too long the draught is increased, thus making it harder for the horses.

The proper adjustment of the coulter is very important, and requires a considerable amount of care. In different lands it requires to be set at different angles; for general purposes it should not be perpendicular, but at an angle of from 50 to 60 degrees with the ground. It should be set to within about an inch of the share, and about 2 inches behind the point. The land side should be parallel with the furrow, and in some soils slightly to the landward of the share, thus cutting a clean slice and reducing the friction of the plough. Circular coulters are preferable in some soils, but must be kept in thorough repair.

The Share.—Different kinds of shares are necessary for different kinds of work, the narrow chilled share being best adapted for hard work, whilst the wider ones for softer land. The share should cut the slice of earth horizontally. The wing should not cut the furrow deeper at its extremity, or otherwise the plough will refuse to pack the earth properly. If the land is hard, and the furrow attempted too wide, the same effect will result. Also, if too much dip is given to the share, the plough will have a tendency to rise out of the ground from behind; the mould-boards are thus taken from their work, and if the plough has handles, pressure must be put on to keep it in the soil. For very hard ground the dip should be taken out of many shares, and they should be kept straight and sharp at the points. Also altering the draught lower at the head will help to prevent a plough from tilting. In very hard land the furrows should not be wider than 7 or 8 inches. Wider furrows can be thrown in softer ground, but shares with wider wings should be used. The sole of the plough should always rest on the bottom of the furrow. And as in some ploughs a wheel is used in its place, care should be taken that it is not set too low, as it would then throw the plough too much upon the point of the share.

To the beginner the horses always prove a source of annoyance; a good ploughman must also be a good driver. If at all practicable, the slow ones should be worked by themselves, as also should the faster ones. In multiple furrow ploughs the mode of placing the horses very often proves a troublesome question, the tandem teams nearly always proving unsatisfactory. With four horses it is advisable to work them abreast, with one upon the ploughed land; the light, active ones will be found to stand the heavy walking the better, the heavier ones doing better upon the solid ground. Even when five horses are used it is preferable to work them abreast, but in some instances the tandem cannot be avoided. In penning the above notes I have realised the extreme difficulty of my task, and fully sympathise with those who have to rely upon printed information on such matters, it being impossible to learn the many lessons necessary without taking hold of the reins and handles.—R. W. PEACOCK, Coolabah.

Replies to Correspondents.

Millet.

Mr. J. Burgess, of Ruby Hill, Walcha, writes: "I have tried growing Pearl and Hungarian millet, as recommended in the *Gazette*, and find that it grows very well in dry weather. I intend putting in a larger area next year. I should like information as to the proper time to cut the crop for seed, also the easiest way of threshing and cleaning the seed."

Mr. Geo. Valder, Principal, Hawkesbury Agricultural College, says Hungarian millet should be cut with a reaper and binder, if possible, and stooked just before it is ripe. As soon as it is fairly dry, it can be easily cleaned with the ordinary threshing-machine, but the machine requires to be more closely set than for wheat. An ordinary seed-cleaner, with sieves, in which the mesh is small enough, is all that is required for cleaning the seed.

Pearl millet is usually threshed by hand, as it is far more difficult to get the seed off the ear, but, unless very largely required, the hand-threshing is not a difficult matter.

Precautions to be observed in putting Cattle into Lucerne Paddocks.

Mr. E. R. Hall, of Blairmore, Aberdeen, N.S.W., has raised a question of very great importance to pastoralists who have laid down lucerne paddocks. Mr. Hall writes: "Will you kindly favour me with a report as to whether the danger to cattle grazing on green lucerne (uncut) may not be greatly lessened by allowing access to paddocks only when the lucerne is just coming into flower? I am anxious to lay down a large area under lucerne for fattening purposes during dry seasons, but would like to obtain all the information I can before making a start in the undertaking."

The question was submitted to Mr. J. L. Thompson, Travelling Instructor in Agriculture, who has had extensive experience in grazing stock on lucerne. Mr. Thompson thinks it would be difficult to work the idea suggested by Mr. Hall of turning the stock in first before flowering. There is no risk from grazing on lucerne at any stage of growth provided the stock are put on it for the first time with a full stomach. Attention is drawn to Mr. Thompson's article on the cultivation of lucerne in the Farmers' and Fruit Growers' Guide.

Artificial Manures.

Mr. W. Schilg, of Burrumbuttock, *via* Albury, writes: "In several instances it has come under my notice that some of the farmers here are disinclined to use phosphates or other artificial manures, the reason

being that they are impressed with the idea that the use of such manures will in the course of a few years utterly impoverish their lands. A report has been spread that where guano was used for a time in South Australia the soil lost all fertility, and for that reason some farmers are afraid to, and refrain from using artificial manures. This feeling of uncertainty affects the farming community very considerably, and I feel sure that you will concur that the doubt should be removed, and the correct tendency of such manures be made generally known."

This remarkable communication has been brought under the notice of Mr. Guthrie, Chemist to the Department, who says that the idea that guano or any other manure, properly applied, tends to impoverish the land is an entirely fallacious one. The loss of fertility in South Australian soils is, Mr. Guthrie thinks, primarily due to overcropping and the system of bare-fallowing which is extensively carried out.

Best Late Peaches for Hawkesbury District.

In reply to the Rev. Henry Woodhouse, of Sackville Reach, Hawkesbury River, who asks for a list of the best varieties of peaches that are ready for market from about 20th January to the end of the season, Mr. W. J. Allen, Fruit Expert to the Department, reports: Early Crawford, Late Crawford, Elberta, Orange Cling, Lady Palmerston, and Picquet's Late ripen from middle of January till latter end of March in the order named, and are all good marketable varieties. Henrietta and Susquehanna are also two very large and showy freestone peaches, which do exceptionally well in that district.

Mr. Woodhouse mentions that he introduced from America the following peaches:—The Globe, Foster, Humber, Lady Ingold, Reeve, Favourite, Brandywine, Shipley's Late Red, Christiana, Chinese Cling, Silver Medal, Bonanza, The Wonderful, Beer's Smock, Clair's Choice, Powell's Beauty, Richardson's Choice, Crimson Beauty, and some twenty others; but the latest good peach he has is The Globe, which he finished marketing on 28th January.

Mr. Woodhouse has also tried several other varieties, including the Italian, but is not satisfied with them.

The Digestibility of Foods for Different Stock.

Mr. A. F. T. Somerville, of Kurrajong Heights, has suggested the preparation of a table showing "the digestible (for fowls) nutriment in various foods."

The Chemist, Mr. F. B. Guthrie, regrets that there is no such table available, and the labour of preparing one sufficiently exact to be of any utility would be enormous and practically impossible. To test the digestibility of one food for one animal is a work involving years of experimentation, and then, even in the most carefully graded stock, a given food would, for many reasons, be found to possess varying degrees of digestibility.

Covering Ensilage with Straw and Earth.

Mr. Cecil Huband-Smith, of Terry's Plains, inquires whether first covering the stack with a thick layer of straw, and then putting on about 3 feet of earth to serve as a waterproof roof, with weights added as well, is likely to be successful.

Mr. J. L. Thompson, Travelling Instructor in Agriculture, considers that the system mentioned will prove satisfactory. Nothing can equal earth for the purposes of weighting, and, as Mr. Smith points out, it will form a waterproof roof.

The method of putting up ensilage described hereunder will, however, be found equally satisfactory, and will not prove so laborious. Since Mr. Thompson first published these particulars of what is commonly known as the *Economical Ensilage Stack*, a great many farmers have adopted it in various parts of the Colony, and all find that the fodder is conserved in splendid condition.

Maize, oats, barley, and all other crops intended for ensilage should be fully grown, but quite green and full of succulence, the ear well formed and in the milky condition. It should be cut quite close to the ground, and left on the land in armfuls, and kept as straight as possible. The sooner it is carted to the stack after being cut the better; low drays or sledges will be most convenient for this work. A site for the stack should be selected as high and dry as possible. A straight trench should be cut 9 inches deep right round the foundation, and ran gradually out to nothing, and the earth so removed should be spread evenly over the foundation, thus raising it above the ordinary level. If possible a small drain should be constructed to carry off the water accumulating in the trench. With regard to the size of the foundation of the stack, care must be taken not to make it too large for a given quantity of material, otherwise when consolidated the stack will be too low, and there will be consequently more waste. One hundred tons of ensilage can be built on a foundation 21 x 18 feet, and a 20-ton stack would not require more than 9 x 8 feet. The larger the stack and the higher it is built the less waste, and *vice versa*. A foot of summer grass or green rubbish of any kind should be put on the foundation. This will take the mould and save the good material from waste. In building, stalks should all be laid as far as possible one way, so as to pack better, and with a small stack they must be laid fore and aft, or the long way of the stack, with the exception of an armful here and there to bind the stuff more compactly. By building slowly the stack will keep sinking, and consequently the stuff will not require to be lifted so high. When a large quantity of ensilage is being made, some mechanical contrivance should be arranged to hoist the material from the dray on to the stack, but for a small stack, of course, it would not be worth while erecting it. A straight pole should be put into the ground 4 feet deep and about 10 feet above ground at each corner of the stack, and one at each side, perfectly plumb, as a guide for the builder. This will assist greatly in enabling him to keep the stack in good shape. After all the material is put on the stack, at least 2 feet deep of green grass

or rubbish of any kind should be put on top. This will take the mould, and will help to weigh down the material and save the good fodder. Although there are some excellent mechanical appliances for giving the necessary pressure, such as Johnson's patent, &c., for a small stack nothing can equal dead weight. This may consist of blocks of wood, posts and rails, earth in bags, or any material that will give sufficient pressure to weigh down the stack. From 150 to 200 lb. per square foot will be required to give the necessary weight. Above the weights should be arranged some sort of covering to keep out the rain—either a tarpaulin or a few sheets of iron. No water must enter the stack either at the bottom or the top, otherwise the ensilage will be spoiled. If there are any straggling stalks projecting from the stacks, they should be neatly trimmed off with a sharp hay-knife.

Burning Stubble.

Mr. Robert Pollock, of Quirindi Creek, asks whether the burning of stubble on wheat land is in any way detrimental to the land, as it is the general practice in the Quirindi District to set fire to the stubble soon after harvesting.

"The practice of burning stubble," reports Mr. J. L. Thompson, "cannot be too strongly condemned. For permanent and profitable farming no one can afford to lose his straw by this wasteful method. Wheaten straw saved in the best condition, cut up into chaff and fed to stock with a little grain or molasses, will keep them in good heart and condition during periods of drought, and if we refer to the market reports at any time, it will be noticed that the demand for wheaten straw is invariably good, at prices that will well repay systematic harvesting. Certainly when the stubble is burnt fertiliser in the shape of ashes is dropped on the soil, but the chances are that it gets nearly all blown away, and the returns from straw treated in this way are infinitesimal."

Preserving Melons for Milch Cows.

Mr. H. J. Mothram, of Nowra, asks for information as to the value of jam melons for milch cows—whether they are of equal value to green oats, or broadcast maize; also whether they are good, boiled with corn, for pigs.

Mr. Geo. Valder, Principal of the Hawkesbury Agricultural College, says preserving melons are valuable for feeding to milch cows, especially in conjunction with dry foods like chaff, but they are not nearly equal in feeding value to green oats or corn. For feeding to pigs he prefers to use the melons uncooked. At the College farm large quantities of melons are utilised in this way.

The Effects of Bluestone upon Wheat in Dry Seasons.

Mr. Geo. Sheppard, of Orange-tree Point, Wagga, raises the question as to whether treating wheat with bluestone to prevent smut tends to

retard the growth during dry seasons, an acre or so of wheat planted early last year without bluestone having given better results than that treated in the usual manner. Mr. Sheppard has eight sample stools of wheat pulled at different intervals dated and with rainfalls between samples noted. The first, pulled 30th September, 1898, showed good sample from 12 inches to 15 inches high, green and in good condition. The fourth, pulled on 22nd October, was to all appearance dead. The eighth, pulled 5th November, was about 2 feet high, with heads bearing little or no grain. The crop was cut for hay, and went about a ton to the acre. The patch sown same time in same paddock, but without bluestone, did not turn so brown, had more grain, and was higher, but unfortunately samples of it were not kept at the various stages of growth.

The Wheat Experimentalist, Mr. W. Farrer, expresses the opinion that treatment with a strong solution of bluestone is apt to make the grain slow in sprouting, but he was not aware that it was apt to make the aftergrowth to be slow, though he is not surprised that such is the case. Bluestone is not entirely satisfactory for preventing bunt; but it is better, Mr. Farrer thinks, than the hot-water treatment, because much more convenient. This year Mr. Farrer is experimenting with simply washing the grain in four or five changes of water. It is thought that agitating the grain in changes of water in a suitable churn, as was recently suggested, would be likely to give good results. If the bluestone treatment is availed of, the use of air-slacked lime afterwards gives such superior results as to be almost necessary. Treatment with fresh wood-ashes, which consist largely of lime, after soaking the wheat in bluestone, would be worth trying. Personally, the Wheat Experimentalist prefers a short immersion (say of three minutes) in a bluestone solution of a strength of 1 lb. of bluestone to 4 or 6 gallons of water, because so much more convenient than the immersion in a weaker solution so often recommended.

"Take-all" in Wheat.

Mr. E. H. Sandrae, of Savernake, reports that his wheat crops are subject to a great deal of "take-all," and he asks for advice as to treatment.

Mr. Farrer, Wheat Experimentalist, states that he had some patches of "take-all" in his land, and he gave it a slight dressing, at the rate of about 70 lb. to the acre, of sulphate of iron, in the early spring, and since then he has not been troubled with "take-all." As much as 1 cwt. per acre would not, Mr. Farrer thinks, be too much for a dressing. The cost is 8s. per cwt. In answer to Mr. Sandrae's inquiry as to what oat can be recommended as the best all-round one for grain, straw, and yield, Mr. Farrer, who does not profess to have paid much attention to varieties of oats, suggests the Potato variety as one that has an excellent reputation as a prolific yielder of grain and the Tartarin and Algerian for hay. The Dunn oat might also be worth trying.

Irrigation.

Mr. James Brogan, of Attunga, writes: "I intend (if practicable) to raise water from a well by syphon on my farm. The farm is 48 chains long, and runs along the bottom of a shallow valley, the lower end being about 35 feet lower than the upper end. I believe I could obtain water on the high end at about 20 feet, which would give the water in the well an altitude of about 12 feet above the outlet of the syphon, which would be about 44 chains from the well. I wish to know: 1st. Would the distance between the source of supply and the outlet of syphon have a decreasing influence against the flow of water through the pipe, such distance being 44 chains? 2nd. If so, could anyone connected with the Department of Agriculture, or any of its readers, give an estimate of what would be the daily supply of water through a 1-inch-bore pipe of the above length and pressure? 3rd. Would it make any difference in the flow of water to have the pipe up and down in 8 and 10 feet hollows between the source of supply and outlet? I am quite confident that, unless the matter of distance would militate against the flow of water through such a syphon, the expense of such a venture would be amply returned on a farm like mine, and would be far more satisfactory in every respect than a windmill. All I would require to water an acre or two would be a good well, which I and many another could obtain on farms like mine."

Mr. W. J. Allen, Fruit Expert, who has had very extensive experience of irrigating land for orchard and general agricultural purposes, reports: "A 1-inch pipe, 1,000 feet in length, would deliver (if the grade is even), with a 4-foot pressure, about 2,350 gallons of water every twenty-four hours. A 2-inch pipe would run under similar conditions about 17,856 gallons. In laying the pipes it would be necessary to take every precaution to see that the joints were perfectly air-tight, and therefore in connecting the pipes it would be well to use red lead. It would be necessary also to have a stop-cock at the lower end, and at the highest point it would be well to have a plug which could be removed when it was intended to fill the pipe (or syphon) before the water starts to run. I have seen a syphon similar to this, and it did splendid work, giving entire satisfaction. If the pipes are not laid on a fairly even grade it would tend to diminish the flow, and especially so where there would be such a difference as 8 to 10 feet in the level. In such an event I would recommend supporting the pipe on trestles."

Irrigation on a Small Scale for Pastoral Purposes.

In answer to an inquiry as to whether it is profitable to irrigate on a small scale in the Western District, more especially for lucerne crops, Mr. C. H. Gorman, Manager of Pera Bore Experiment Farm, reports: Many pastoralists now recognise the advisability of producing crops under irrigation in the Western Districts. Where water is obtainable from artesian bores it is certainly profitable, but I hardly think it would pay to erect a pumping plant to cultivate a small area, unless

the water could be utilised for other purposes, which would reduce the cost of irrigating. It certainly pays anyone with stock to feed to cultivate under irrigation, more especially as there is nothing to show that we may not be forced to go through a similar season to the present. Increased yields will be obtained and a sure crop. In irrigating lucerne paddocks the most approved plan is flooding in ½, ¾, or 1 acre checks. If the checks are properly laid out this will be found the best way, as no waste of water will follow.

Vines and Strawberries for Dundas District.

Mr. P. J. Doratz, of Kissing Point Road, asks:—

1. What grape is considered most suitable for growing on trellises?
2. What depth should the ground be trenched?
3. Should the top soil be put in the bottom of the trench and the clay on top, or should the earth be replaced in the way it comes out?
4. May strawberries be grown on the ground trenched while the grape is maturing? If so, what particular varieties can be recommended?

To which the Fruit Expert, Mr. W. J. Allen, has furnished the following replies:—

1. White and Red Prince, Blue Imperial, Gros Guillaume, Mrs. Pearson, Almerian (Red and White), Goethe, Iona.
2. At least 18 inches.
3. It would be best to place the earth back in the same position, and, with it, put in about 4 cwt. of the following mixture:—

13 parts	bone-dust	This to be well mixed, and applied 4 cwt. to the acre.
5 ,,	superphosphate	
1½ ,,	sulphate of potash	
½ ,,	ammonia	

4. It will not hurt to grow strawberries on the ground with the grapes, as the good work and manure necessary to make strawberry-growing profitable will also do the vines good. The Marguerites, Ediths, and Trollope's Victorias, appear to do very well; but I would recommend inquiring of strawberry-growers in that district as to which varieties yield the best, and endeavour, then, to get plants of these varieties.

In the *Agricultural Gazette* for December last Mr. Allen had an article on strawberry-culture. Copies of the article in, pamphlet form, may be had on application to the Department.

Oats in Wheat-paddocks.

Mr. Robert Pollock, of Quirindi Creek, writes:—"I see in the 'Replies to Correspondents' that some farmers are puzzled by the appearance of oats in their wheat-paddocks. I think it is black oats they mean,

as it is only at a certain season of the year that the black oats will germinate; that is, from about the 1st of May to August. I think the best way to get rid of them is to leave the land out of crop for a year, cultivating it well during the autumn and winter months of that year. Of course in expressing this opinion, somewhat contradictory to that expressed by Mr. Farrer, I may be wrong."

Mr. Farrer does not consider Mr. Pollock's view of the matter contradictory to his remarks on the subject. Mr. Pollock is right about wild oats germinating during the winter months, but it is questionable if their germination is exclusively confined to that time, though the great majority of the seeds undoubtedly come up then.

Mr. Pollock also makes reference to the practice, common in the district, of burning the wheat stubble. Mr. Farrer regards the method as a most wasteful one. The bare-fallowing system is also to be condemned. What the soil wants, especially in our climate, is vegetable matter, and it is very seldom that anything but good comes from ploughing in vegetable matter, and as much of it as possible. Would it not be more profitable to grow a crop of rye on oat-infested land than to bare-fallow it, eating the crop off with sheep or horses, and plough the paddock in early summer? The wild-oat plants which come up will be eaten by the sheep, and the rest will be killed by the ploughing.

Turning under Grass in Orchards.

Mr. J. H. Stewart, of Lyle Hurst, Castlereagh, asks, whether turning under grass, &c., with the plough and thereby adding humus to the soil is not better than wasting the material by dragging it off the land with the scarifiers?

Mr. W. J. Allen, Fruit Expert, states, that unless this district is a moist one the orchard should never be ploughed in summer, but may be ploughed in autumn and winter, at which times if there should be any grass growing, it would be best to turn it under, as it tends to keep the ground loose as well as adding humus. However, the land should be kept continually stirred with the scarifier during the summer, which, if properly done, will keep down all weeds and will not expose the moist soil to the sun and air, nor rob it of moisture, as would ploughing. In a moist climate ploughing may be practised, if the weeds should get the upperhand owing to excessively moist weather.

Irrigation by Gravitation.

Mr. Thomas Waldron, of Junction Farm, Hartley Vale, asks for advice about irrigating his farm on which there is a natural fall from the river. He asks, whether it would be better to irrigate direct from the river or use a California pump or other appliance to raise the water?

Mr. W. J. Allen says: "As this correspondent's farm is so situated that he can irrigate by gravitation, I would certainly recommend that

he should do so, in place of trying to lift water with a pump, which would require to be run either by horse or steam power. Construct a good strong dam with a box or pipe so built in that it can be opened and shut at will for the purpose of drawing off nearly all the water or any part as may be required. A ditch would have to be constructed, in order to run the water from the tank to the land intended to be watered. For a small stream it should be 12 inches deep, 12 inches wide at bottom, and 3 feet wide on top. This will hold sufficient water to irrigate from 5 to 8 acres per day. Do not give the ditch too much fall, or the water will wash it until it will become a large channel; 1 foot fall in 2 chains is quite sufficient, and even less than that for large streams. In irrigating trees, vegetables, or cereals the water should be confined to small furrows, through which it should be allowed to flow slowly, and trees or vegetables should receive a thorough cultivation as soon as the land is dry enough after irrigation. In every case the land should be thoroughly levelled before being planted with anything, as good work cannot be accomplished on rough land, and the results are far from satisfactory."

Preserving Eggs in Water-glass.

"INQUIRER" asks for information as to the method of preserving eggs with water-glass (silicate of soda).

Mr. McCue, Poultry Expert at the Wagga Agricultural College, reports: "The proportions are one part of water-glass (costing per lb.) with ten parts of water. The water should be boiled before using, and when nearly cool add the water-glass and stir well. When well mixed and cold, it is ready to receive the eggs. The barrels, jars, or tins should be cleaned well with boiling water before putting in the preserving mixture. All eggs should be perfectly clean and fresh before being put in the liquid."

Cholera and Fluke in Fowls.

"INQUIRER" also asks (*a*) if cholera in fowls is ever accompanied by a rattling in the throat; if not, what is the disease of which the symptoms are similar to those of cholera (McCue's *Poultry Guide*) with the addition of rattling in the throat? (*b*) Is fluke ever destructive in a fowl-yard; if so, what are the symptoms and cure?

In answer to the first question, Mr. McCue says cholera is sometimes accompanied by the complaint mentioned, generally the result of canker—a cheesy accumulation that gathers at the opening of the wind-pipe. The fowls may have had roup, which often stops the wind-pipe with a thick mucus.

Concerning fluke, Mr. McCue has never heard of it being destructive to fowls. If fowls were affected by fluke, they would show the symptoms that attend liver complaints, viz., a pale face and comb, and become drowsy and thirsty.

White Comb and Roup in Fowls.

Mr. Jas. Millar, of Gilmour, Parkes, writes: "I bought some thoroughbred Leghorn fowls last January, and they seemed in perfect health. In April some of them developed a sickness I have not seen before—a white mouldy appearance on the comb—then a "sloughen" of the eye, and, in the case of one fowl, loss of one eye; an appearance as if crop-bound; a sound like hiccup or barking "peyuk." I gave the fowls a mixture of soot, sulphur, pepper, and lard, as recommended in the *Gazette*, then spice pills and then Epsom salts with a decoction of aloe-plants to drink. I had been feeding wheat, but changed the ration to warm mash of bran and pollard. They have a large run. I put each fowl under treatment in a large box and sulphured the combs, eyes, and head. One is quite well, but the disease is still rampant, and the rooster looks very bad on it, although I have him in hospital, warm and comfortable.

I clean and lime the roost every week. I had no sickness among my former flock of White Leghorns which I kept for years."

From Mr. Millar's description of the disease among his fowls, Mr. McCue thinks they have "White Comb" and "Roup." The first is generally caused by bad sanitary surroundings and absence of green food. White Comb can be cured by applying Holloway's ointment on the comb after it has been well washed in soap and water, lukewarm. The fowl should be housed and fed well, to build up the weakened system. The second ailment is caused by variations in temperature, damp houses, improper food, draughts, and dirty water. It is a contagious disease, and large numbers of birds have been lost through the thoughtless introduction of a roupy bird into a healthy flock.

The best way to cure roup is when it is in its first stage—cold or slight catarrh. A simple remedy for this stage is kerosene, injected with a common sewing-machine oil-can into the fowl's nostrils and slit in the roof of the mouth. Add bromide of potassium to the drinking water for the whole flock, in the proportion of about two grains to each fowl, for three or four days. If the fowl has reached the third stage—enlarged head, semi-thick mucous discharge, and a dumpish condition—it is best to destroy the fowl, which should be burnt or buried deep. I would never breed from a fowl that had roup in the third stage, for you will surely have the disease to cure in the chickens.

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society	A.B. Chippindall	Jan. 11, 12
Lismore A. and I. Society	T. W. Hewitt	,, 18, 19
Gosford A. and H. Association	W. McIntyre	,, 20, 21
Kiama Agricultural Association	J. Somerville	,, 25, 26
Wollongong Agricultural Association	J. A. Beatson	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery	,, 7, 8
Manning River A. and H. Association	W. Plummer	,, 9, 10
Liverpool Agricultural Society	J. E. Wilson and G. L. Sutton, Hon. Secs.	,, 9, 10, 11
Berrigan Autumn Show	R. Drummond	,, 15
Ulladulla A. and H. Association	C. A. Cork	,, 15, 16
Lithgow A. H. and P. Society	M. Asher	,, 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society	E. H. Sargent	,, 17, 18
Tumut A. and P. Association	M. McNamara	,, 22, 23
Alstonville A. Society	N. R. Elvery	,, 22, 23
Port Macquarie and Hastings A. and H. Society	J. Y. Butler	,, 23, 24
Bega A., P., and I. Society	John Underhill	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes)	John Priest	,, 1, 2
Robertson Agricultural and Horticultural Society	R. G. Ferguson	,, 2, 3
Robertson A. Society	R. G. Ferguson	,, 4, 5
Upper Murray (Tumbarumba) P. and A. Society	W. Willans	,, 7, 8
Tenterfield Intercolonial P., A., and M. Society	T. W. Hoskin	,, 7, 8, 9, 10
Cudal A. and P. Society	C. Schramme	,, 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood	,, 8, 9
Oberon A. H. and P. Assoc.	Alfred Gale	,, 9, 10
Berrima District (Moss Vale) A., H., and I. Society	H. Richardson	,, 9, 10, 11
Castle Hill and District A. and H. Association	F. H. Rogers	,, 10, 11
Cobargo A., P., and H. Society	T. Kennelly	,, 14, 15
Southern New England P. and A. Association (Uralla)	P. M. O'Connor.	,, 14, 15
Inverell P. and A. Association	John McGregor	,, 15, 16, 17
Nepean District (Penrith) A., H., and I. Society	E. K. Waldron	,, 16, 17
Gundagai P. and A. Society	A. Elworthy	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17
Candelo Agricultural Association	C. H. Brooks	,, 16, 17
Cumnock P. A. and H. Assoc.	W. L. Ross	,, 17, 18
Walcha P. and A. Association	F. Townshend	,, 21, 22
Blayney A. and P. Association	H. Woolley	,, 22, 23
Upper Hunter (Muswellbrook) Agricultural Society	J. C. Luscombe	,, 22, 23, 24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Bangalow A. and I. Society	John R. Wilson	,, 23, 24
Crookwell P. and A. Association	M. P. Levy	,, 23, 24
Warialda P. and A. Association	W. B. Geddes	April 5, 6
Gulgong A. and P. Assoc.	C. E. Wilton	,, 7, 8
Mudgee Agricultural Society	J. M. Cox	,, 11, 12, 13
Cooma P. and A. Assoc.	C. J. Walmsley	,, 12, 13
Clarence P. and A. Association	Jas. C. Wilcox	,, 13, 14
Lower Clarence Agricultural Society (Maclean)	G. Davis	,, 18, 19
Richmond River (Casino) A., H., and P. Society	Jas. Tandy	,, 19, 20

Society.	Secretary.	Date.
Hunter River A. and H. Association	W. C. Quinton..	April 19, 20, 21
Orange A. and P. Association	W. Tanner, jun.	,, 26, 27, 28
Wellington P. and A. Soc.	R. Porter ...	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	.. ..	,, 4, 5
Coonamble P. and A. Association...	F. C. Lamotte...	,, 10, 11
Dubbo P. A. and H. Assoc.	H. Munckton ...	,, 9, 10
Hawkesbury District A. Assoc. (Richmond)	C. S. Guest ...	,, 11, 12, 13*
Mudgee Agricultural Society	J. M. Cox ...	,, 16, 17
Walgett P. and A. Assoc.	Thos. Clarke ...	,, 17, 18
Durham A. and H. Assoc.	C. E. Grant ...	,, 17, 18
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20
Moree P. and A. Society	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Assoc.	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association	N. A. Read ...	,, 1, 2
Parkes A. and H. Association ·	J. H. Lane ..	,, 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Soc.	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
Junee P. A. and I. Association	T. C. Humphrys	Sept. 6, 7
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Yass P. and A. Association	W. Jermyn ...	,, 21, 22
Temora P., A., H. and I. Assoc.	W. H. Tubman	,, 27, 28
Burrowa P. A. and H. Association	F. H. Tout ...	,, 28, 29
Berry A. Association	A. J. Colley ...	Dec., 6, 7, 8

1900.

Dapto A. and H. Society	A. B. Chippendale	Jan., 10, 11
Wollongong Agricultural Association	T. A. Beatson	,, 31, Feb., 1, 2
Alstonville Agricultural Society	H. R. Elvery ...	,, 14, 15
Tenterfield I. P. A. and M. Society, Show	F. W. Hoskin ...	Mar., 6, 7, 8
,, ,, Fair days	,, ...	,, 9, 10
Lismore A. and I. Society	T. W. Hewitt ...	,, 7, 8

* Entries close 20th April.

[11 plates.]

Sydney: William Applegate Gullick, Government Printer.—1899.

AGROSTIS VENUSTA, Trin.

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist, Director of the Botanic Gardens, Sydney.

No. 52.—*Agrostis venusta*, Trin.

Botanical name.—*Agrostis*, a Greek word signifying grasses in general—a derivative of *agros*, a field; hence the word "Agrostology," the science of grasses. *Venusta*, Latin for graceful, in allusion to the appearance of the grass when in flower.

Botanical description (B. Fl. vii, 576).—A slender, tufted grass, closely resembling the typical form of *A. scabra*, with still finer leaves.

Panicle loose, with long capillary branches, or contracted in some of the smaller specimens.

Outer glumes very acute, about 1 line long.

Flowering glume shorter, broad, hyaline, and remarkably truncate, enveloping the flower with a dorsal twisted awn, affixed very near the base and protruding beyond the outer glumes.

Palea, none.

There is a figure of this species (Plate CLIX) in Hooker's *Botany of the Antarctic Voyage*, Part iii, *Flora Tasmaniæ*; but the awn, usually twisted, is there shown as quite straight, or nearly so. In our figure it is shown with a decided bend or twist. We have specimens showing all stages of bend, so that the character is not constant.

Value as a fodder.—A small grass, an ingredient of pastures, and probably nutritious, but we have no data in regard to its value in this respect.

Habitat and range.—Found in all the colonies. In New South Wales, found in southern mountainous (particularly Alpine) districts. We have it from Pretty Point (Mt. Kosciusko, 5,500 feet).

Reference to Plate.

a. Portion of inflorescence.
b. Spikelet.
c. Flowering glume, showing bent or twisted awn.
d. Grain.

Some Exotic Grasses.

By J. H. MAIDEN.

No. 3.—The Carpet Grass of the Southern United States (*Paspalum compressum*, Nees)—a valuable introduction to the Colony.

A few months since Mr. R. Vowell, of the Roads Office, Murwillumbah, Tweed River, brought under my notice a peculiar-looking grass with very broad leaves, looking very much like Lamb's Lettuce (*Plantago*). As it was not in flower, I had to wait until it arrived at that stage, and then I found that it was not an Australian grass, and that it does not appear to have been recorded hitherto for Australia. It turns out to be the Louisiana or Carpet Grass of the Southern United States—*Paspalum compressum*, Nees, of some botanists. As it came from the Tweed, I asked Mr. F. M. Bailey if he had yet found it in Queensland, and he replied that he had not; but it is only a question of time when it will be found in the sister colony.

Subsequently I received it from Mr. H. M. Williams, of Wollongbar, Richmond River.

It promises to be a useful grass for the dairy farmers of the northern rivers, and I trust that it will be planted at the Experiment Farm, Wollongbar, so that farmers may soon obtain samples for purpose of test. It is best to send rooted pieces through the post. Every piece of it will grow in warm, moist localities. Wherever possible, I recommend most grasses for experimental purposes to be grown from pieces of the living plant. Planting grass from seed (native grasses in particular) results in failure in the majority of cases.

Mr. Vowell is an Engineer of Roads, but like many of our public officers in the country districts he is always on the lookout for any plant which will benefit farmers and graziers. In reply to one of my letters he says :—" I have watched the grass carefully, and find that

Since the above was in type, Mr. Bailey recollected that he had already recorded this grass from Queensland (as *P. platycante*). Following is the reference :—" Cairns, and along the Mulgrave Road. This grass forms a very close flat turf, of a deep bright green, and would be suitable for lawns and for an edging around flower-beds, besides which it is doubtless an excellent permanent pasture grass. It is indigenous in Tropical Africa and America, but whether indigenous in Queensland is at present uncertain."—*Queensland Agric. Journ.*, Sept., 1897, p. 234.

PASPALUM COMPRESSUM, Nees.

cattle are very fond of it, as they keep the only patch there is of it well eaten down. It seems also to be a good hardy grass, as it will stand frost, and also spreads very rapidly. When I first found it, about ten months ago, there was only a small patch about a foot square. This has since spread into a piece about 30 x 18 feet, besides supplying about 500 plants, which have been planted out both here and on the Richmond, and are growing well. As far as I can learn there is only the one patch of it in the district, and I desire to protect it, or else it will be exterminated.

"The strongest points I can see in its favour are that it grows well in poor soil (clay), and is also green in winter, when the grass all round is killed by frost."

Paspalum compressum (Sw.), Nees, is called "Flat Paspalum," and is figured at p. 109, of vol. i, of Britton and Brown's *Illustrated Flora of the Northern United States*, &c.

It is figured (as *P. platycaule*) in Vasey's *Agricultural Grasses and Forage Plants of the United States*.

It is also figured in Lamson-Scribner's *American Grasses* (Bulletin No. 7, Division of Agrostology, U.S. Dept. of Agriculture). The following description of it is given:—"A slender, erect, or more frequently prostrate and extensively-creeping perennial, rooting at the nodes and sending up numerous leafy or flower-bearing branches 6 to 24 inches high, with 2 to 6 subdigitate slender spikes and small acutish spikelets. Low ground and moist pastures, abundant near the coast from Virginia to Texas. Found also in Mexico, Central and South America, and the West Indies. A valuable pasture grass."

It is figured as *P. platycaule*, Poir, in Trinius' *Species Graminum*, vol. ii (St. Petersburg, 1828), but none of these plates figure the young foliage, which claims attention by its broadness. In the spring or early summer, when good specimens are available, I may figure it for the *Gazette*.

It is a grass that I recommend without hesitation to the attention of our coast farmers, particularly those on the northern rivers, and attach some American opinions of it.

Thos. H. Kearney, in Bulletin No. 1 of the Division of Agrostology, U.S.A., Dept. of Agriculture, says:—

"It is abundant where it grows, and is probably the most valuable native pasture-grass of that region (Southern States). At Mobile I saw a large pasture belonging to a dairyman covered almost exclusively with Louisiana grass, supporting a dozen or so of cows in fine condition. At Savannah I saw it finer and larger than at any other point."

Prof. Tracy, in Bulletin No. 21 of the Mississippi Experiment Station, says of it:—

"Carpet Grass.—This is a perennial species that is indigenous to the southern part of the country, and which has spread northward until it is now (1892) found occasionally as far north as Booneville, Miss., but which is not abundant, except in the southern half of the State. Its flat and spreading habit makes it of no value for hay, but it furnishes excellent grazing during nearly the entire winter. It grows best on rather low and sandy lands, and will bear closer

grazing and more tramping than any other grass we have. It starts slowly from the seed, but when it is once established it grows rapidly, and a single plant will cover from 10 to 20 square feet in a season. It roots at every joint like the Bermuda, but, unlike that, it can be readily destroyed by cultivation. In favourable localities it occupies the ground to the exclusion of all other plants, even the bitter weed *(Helenium tenuifolium)* being unable to grow through the dense sod. It starts slowly, but plants from seed sown in March are now (January 15) 8 feet in diameter, and are unchecked by heavy frosts."

This is what Vasey says of it :—"*Paspalum platycaule.*—This has sometimes been called 'Louisiana Grass.' It grows flat on the ground, rooting at every joint, and forming at the South a thick, permanent evergreen sod. It does well on almost any upland soil, and is said to stand drought better than Bermuda Grass (the Couch Grass of Australia). It usually grows too short and too close to the ground for hay, but for grazing it apparently has many good properties. It may be distinguished from the other *Paspalums* and from Bermuda Grass by its flattened stems (whence the name *platycaule*), and the very slender seed-stalks, each bearing only two or three very narrow, somewhat upright spikes. The leaves, especially on the long runners, are short and blunt.

"The facts of its being a perennial and seeding freely, of its doing better than any other grass on poor soil, forming a compact tuft to the exclusion of other plants, and of its being easily killed by cultivation, will doubtless recommend it for more extended growth."

Dr. Charles Mohr, of Alabama, says :—"It has taken a firm foothold in this section. It is perfectly hardy, prefers damp localities, and suffers somewhat from long droughts. It grows best in a sandy loam, rather close, compact and damp, in exposed situations, as it does not stand shade well. It stands browsing and tramping well, and is greedily eaten by all kinds of stock. Its vegetation begins earlier in spring than that of Bermuda."

G. A. Frierson, of Louisiana, says :—"It grows everywhere in rather low, wet, clay lands, and stands grazing as well or better than Bermuda."

R. A. Brodnax, of the same State, says :—"It was first noticed here about 1870, in very small patches. Since then it has spread rapidly from seed. It is not cultivated. It stands frost very well when firmly rooted, staying green nearly all winter, and it stands drought splendidly. It grows best on a poor quality of land, high above overflow, or when water could not stand on it. It is a splendid pasture grass, making a sod equal to Bermuda, but it is not cut for hay. It is very easily destroyed, one ploughing being sufficient to destroy it."

Mr. Prentice Bailey, of Florida, says :—"On all old roads, when travel has killed the other grasses and parched the soil, it covers the ground with a close, even turf; it forms such a thick turf that it is called here 'blanket-grass.' The cattle in the woods are so fond of it, and keep it eaten down so close that it is difficult to find any of it more than 2 or 3 inches in height, but on good ground in protected

places it grows to the height of several feet. It is only partially killed through the winter. From the avidity with which it is eaten by all kinds of stock, the closeness of turf formed, its ability to resist almost any amount of tramping, and its rapidity of growth, I think that it is a most valuable grass for this country."

Mr. F. W. Thurow, of Texas, says "that at present (1889) it furnishes about five-eighths of the pasturage in south-eastern Texas, forming a dense sod. Stock of all kinds seem to relish it, but it is not as nutritious as Bermuda Grass."

A Large Forest Oak.

Mr. Forester G. R. Brown sends the following particulars in regard to a very large Forest Oak (*Casuarina suberosa*) found on the bridle-track from Yarrowitch to Moreback Stations, New England. It is near a tree marked by a surveyor broad-arrow over C 93 on the top of a 3-mile hill. Its dimensions are about 70 feet to top of branches, 50 feet to first limb, with a girth of 6 ft. 6 in. there. At a height of 5 ft. 6 in. its girth is 10 ft. 8 in., and 8 inches from the ground its girth is no less than 18 feet. It seems a very healthy tree, and there are several in the locality nearly as large.

Samples of Colonial-grown Manitoba Wheat for Testing.

The Department will be glad to get samples of Manitoba wheat (1 lb. will be enough for the purpose) which have been grown in the Colony for examination in the Departmental mill.

In order that the report of the tests may have the fullest value, senders of samples are requested to be good enough to give on a piece of paper, *placed inside the bag* containing the wheat, the following particulars:—

1. Where the wheat sent was obtained originally, and, if possible, when it was imported, and by whom.
2. For how many generations it has been grown in the Colony.
3. The character of the soil in which the sample sent was grown: *e.g.*, whether a deep black soil, or a red sandy loam, or a clayey heavy soil, or of what particular character.
4. The previous season's crop on the land.
5. Whether the land was manured for the crop; and, if so, with what manure.

For the convenience of senders, and to secure free transmission through the post, labels such as are issued with each *Gazette* may be used, and additional ones will be supplied on application.

Native Food-plants.

(Continued from page 629.)

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

Part IV.

[Dealing with Vols. VI and VII of the *Flora Australiensis*.]

THYMELACEÆ.

Pimelea microcephala, R.Br.

The fruits are eaten by the Mount Lyndhurst (S.A.) aborigines, who call them "Narrima." (Koch.)

All the colonies except Tasmania.

ELÆAGNEÆ.

Elæagnus latifolia, Linn.

The fruit is eaten in India. It is acid and somewhat astringent. It makes good tarts. (Beddome.)

Queensland.

EUPHORBIACEÆ.

Antidesma Dallachyanum, Baill. "Herbert River (Queensland) Cherry."

The fruit, which in size equals that of large cherries, is of a sharp acid flavour, resembling that of the red-currant, which it also equals in colour when made into jelly; and as the European fruit is placed among medicinal plants on account of its juice being grateful to the parched palates of persons suffering from fever, this is worthy of a similar place. (Bailey.) It is an abundant bearer.

The same remarks are applicable to many of the sub-acid fruits mentioned under "Foods."

Queensland and Northern Australia.

Antidesma erostre, F.v.M.

Yields a smaller fruit, resembling the red-currant of Europe.

Queensland.

There is an allied species—*i.e.*, to *Antidesma Dallachyanum*—here, called by the blacks "Koolimbooroo," which is very plentiful along the river banks and round the lagoons. (J. A. Boyd, Herbert River.)

Mr. Boyd further states:—"The blacks could not give me the name for the specimens sent (*A. Dallachyanum*), remarking, 'No Koolimbooroo, nother one mate belong a him.'"

Aleurites moluccana, Willd. (Syn. *A. triloba*, Forst.) "Candle-nut Tree."

The natives of the countries in which this tree grows are very fond of the nut, which is similar in flavour to the common walnut, and very wholesome. It is, however, rather rich, from the quantity of oil it contains.

Queensland.

Omphalea Queenslandiæ, Bailey.

Fruit large, globular, yellow or nearly white, 3 to 5 inches in diameter. Said by Dr. T. L. Bancroft to be edible. (Bailey.)

Johnstone River, Queensland.

Securinega obovata, F.v.M. (Syn. *S. abyssinica*, A. Rich.) Native name on Cloncurry, "Tharginyah"; on Mitchell, "Arrimby."

Fruit small and white, in great quantities; the natives gather them in bark Koolimans to bring into camp. About the size of flat peas; sweet and juicy. Eaten raw. (E. Palmer.)

Western and Northern Australia and Queensland. Found also in Asia, Africa, and the Pacific Islands.

URTICEÆ.

Ficus aspera, Forst. (Syn. *F. scabra*, Forst.) "Rough-leaved Fig." Called also "Purple Fig" and "White Fig." "Noomaie," of the Rockhampton aborigines; "Balemo," of the Cleveland Bay (Queensland) aborigines: "Boorkol," of the Port Curtis blacks.

The fruit, which is black when ripe, is eaten by the aborigines. (Thozet.) Mr. C. Hedley confirms this, as far as the Port Curtis (Q.) blacks are concerned, and Mr. E. Palmer as regards those of the Cloncurry and Mitchell. It is extremely likely that our New South Wales blacks fed on them, but I can find no record that such was the case.

Victoria to Queensland.

Ficus glomerata, Willd. (Syn. *F. vesca*, F.v.M.) "Clustered Fig." "Parpa," of the blacks, according to Thozet.

The fruit, which is of a light red colour when ripe, hangs in clusters along the trunk and on some of the highest branches, and is used as food by the aborigines.

Mr. C. Hedley (*Proc. R. S. Qd.*, v.) mentions that the Port Curtis blacks feed on them, and at the same time states that the settlers make excellent jelly of them. Palmer makes a similar observation.

Perhaps this fig is referred to in the following passage, written about 1770:—"To the northward, we had a kind of very indifferent fig (*Ficus caudiciflora*) growing from the stalk of a tree." (*Journal of The Right Hon. Sir Joseph Banks*, p. 299.)

The ripe fruit is eaten, and is good either raw or stewed. (Gamble, *Manual of Indian Timbers.*) Brandis, however, says: "In times of scarcity the unripe fruit is pounded, mixed with flour, and made into cakes."

Queensland and Northern Australia.

Ficus platypoda, A. Cunn.

On his journey from Western Australia to the overland telegraph line, Mr. John Forrest, on more than one occasion, pronounced the fruit of this tree to be "very good." P. A. O'Shanesy (*Proc. Linn. Soc., N.S.W.*, vi., 736), however, states that the fruit of this species is not edible. But the appetites of explorers frequently become voracious, and not too discriminating.

South Australia, Queensland, and Northern Australia.

Ficus rubiginosa, Desf. "Port Jackson or Illawarra Fig." "Pingy," of the Port Curtis blacks. (Hedley.)

The fruits, which are full of seed, were an article of food of the Port Jackson natives, but the early colonists found them "very nauseous." Mr. C. Hedley states that they are eaten by the Port Curtis (Q.) blacks.

New South Wales and Queensland.

Pipturus argenteus, Wedd. (Syn. *P. propinquus*, Wedd.) "Native Mulberry." "Kongangn,' and "Coomeroo-coomeroo," of Queensland aborigines.

The white berries are eaten by the aborigines. (Thozet.)

New South Wales and Queensland.

This plant is not endemic in Australia.

CASUARINEÆ.

Casuarina stricta, Ait. (Syn. *A. quadrivalvis*, Labill.) "Black Oak," "Shingle Oak," and often "Forest Oak," "Coast She-oak," "Salt-water Swamp Oak."

In cases of severe thirst, great relief may be obtained from chewing the foliage of this and other species, which, being of an acid nature, produces a flow of saliva—a fact well known to bushmen who have traversed waterless portions of the country. This acid is closely allied to citric acid, and may prove identical with it. Children chew the young cones, which they call "oak apples."

All the colonies except Western Australia and Queensland.

SANTALACEÆ.

Exocarpus cupressiformis, R.Br. "Native Cherry." "Tchimmi," of Queensland aborigines; "Coo-yie" is another aboriginal name.

The fruit is edible. The nut is seated on the enlarged succulent pedicel. This is the poor little fruit of which so much has been written in English descriptions of the peculiarities of the Australian flora. It has been likened to a cherry with the stone outside (hence the vernacular name) by some imaginative person.

All the colonies.

Exocarpus latifolia, R.Br. Broad-leaved "Native Cherry," "Scrub Sandalwood." "Oringorin," of Queensland aborigines (Thozet); and "Ballat," of those of Gippsland.

The fruit is edible, being much the same as the preceding species. The fruits of all species of *Exocarpus* are edible.

Northern New South Wales to North Australia.

Fusanus acuminatus, R.Br. (Syn. *Santalum acuminatum*, A.DC.) "Quandong," "Native Peach." Used to be called "Kelango" by the blacks of Moorunde (on the Murray, S.A.) (Eyre.)

The fleshy pericarp which envelopes the seed known as the Quandong makes an excellent sub-acid preserve and jelly, It is somewhat of the same

flavour as the black guava. By simply extracting the stones and drying the fruit in the sun, it may be used when convenient, just like preserved apples. The kernel is also edible, being very palatable. It is quite spherical.

Miss M. A. Clements has been good enough to send me a parcel of this dried fruit, and she also favoured me with the following directions:—"They require to be soaked in water for a few hours, and then gently stewed with a good deal of sugar, as they are very acid, when they may be put into a tart or eaten with cream." When treated in this way they form a very pleasant dish of good colour, but not equal to our garden fruits. It would be interesting to see what cultivation could do for this pleasant native fruit. It is a favourite food of emus.

Interior of all the colonies except Tasmania and Queensland.

Fusanus persicarius, F.v.M. (Syn. *Santalum persicarium*, F.v.M.) "Native Sandalwood."

The root-bark is used as food by the aborigines. (*See Eucalyptus dumosa.*) (Mueller, *2nd General Report*, 1854.)

Also mentioned by Wilhelmi as used by the natives of the Murray, near Swan Hill, who describes it as tasteless but nutritious, and it is prepared in the same way as other roots, viz., by roasting in hot ashes.

Interior of all the colonies except Tasmania and Queensland.

Leptomeria acida, R.Br.; *L. aphylla*, R.Br.; *L. Billardieri*, R.Br. "Native Currants."

The berries are edible, having a pleasant sub-acid flavour. They are useful to quench the thirst when in the bush, and are used for making jelly and preserve. The jelly is of a pale colour, and has a delicate flavour when the acidity has been masked by a sufficiency of sugar. It is an excellent substitute for red-currant jelly, as I can testify. The fruits of *Leptomeria acida* have been examined chemically by Mr. (now Dr.) Rennie. (*Vide Proc. Roy. Soc.*, N.S.W. p. 119, *et seq.*)

In 1811 Mann wrote of Port Jackson, "native green currants grow wildly, and make an uncommonly fine jelly." Barton's *History of N.S.W.*, i, 345.

Tasmania, New South Wales, and Queensland (*L. acida*); South Australia, Victoria, and New South Wales (*L. aphylla*); Tasmania, New South Wales, and Victoria (*L. Billardieri*).

Santalum lanceolatum, R.Br. "Sandalwood." The "Tharrah-gibberah," of the aborigines of the Cloncurry River (North Queensland).

This tree produces a small purple fruit of very agreeable taste. (Leichhardt's *Overland Journey to Port Essington*. p. 95.) Otherwise described by E. Palmer as a brown or black drupe, oblong, of a sweet taste, and the size of a small plum.

"Blacks eat the fruits in South Australia. A friend of mine asserts that on a hot summer's day, accompanied by a black boy, he was driving a flock of sheep and met a tree loaded with ripe fruit. Both ate a large quantity of it and fell asleep. Awaking, they drove the sheep farther on, and met with another tree, ate some more fruit, with the same result. My friend is of opinion that the berries contain narcotic properties." (Max Koch.)

All the colonies except Tasmania and Victoria.

CONIFERÆ.

Araucaria Bidwillii, Hooker. "Bunya Bunya."

Following are Bidwill's own words. (Hooker's *London Journal of Botany*, ii, 505, 1843.)

"The native name of this tree is Banza-tunza or Banya-tunya. The fruit it is said ripens only once in three years, and the precise period of the year when it does ripen seeds does not seem to be known to the aborigines, who visit the trees at different periods to mark how it advances. The seed, which is twice as large as that of Chili Pine (*A. imbricata*), before it is ripe is very sweet, but acquires the same bean-like flavour which has been remarked in those of *A. imbricata* as it approaches maturity. It is greedily eaten by the natives at all times, before ripeness, raw; and when ripe, roasted and pounded into cakes. I have never heard of any white man who has tasted the ripe seed."

Writing from Wide Bay River under date 7th August, 1843, Leichhardt says: "The Bunya Bunya is by no means a yearly regular crop; it gives rather a feast to the blackfellows than food; many tribes come at that time to the district, and fight day after day, while the women collect the cones and seeds of the tree, and prepare the dinner." (Dr. Lang's *Cooksland*, p. 83.) At p. 89, Leichhardt, writing from Archer's Station, under date 9th January, 1844, says: "The blackfellows go up to the top of these giants of vegetation with a simple bush-vine . . . The blackfellows eat an immense quantity, and, indeed, it is difficult to cease, if one has commenced to eat them . . . the kernel of the Bunya fruit has a very fine aroma, and it is certainly delicious eating, but during a very hot day, or from an unfavourable tree, the fruit is by no means so tasteful as I hoped to find them generally. The blackfellows roast them, and we even tried to boil them; the fruit lost, however, its flavour in both cases. Besides, it did not agree with my stomach. The blackfellows thrive well on them, but Mr. Archer told me that the young people return generally with boils all over the body, and I witnessed myself some cases."

"The cones shed their seeds, which are 2 to $2\frac{1}{2}$ inches long by $\frac{3}{4}$ inch broad; they are sweet before being perfectly ripe, and after that resemble roasted chestnuts in taste. They are plentiful once in three years, and when the ripening season arrives, which is generally in the month of January, the aboriginals assemble in large numbers from a great distance around, and feast upon them. Each tribe has its own particular set of trees, and of these each family has a certain number allotted, which are handed down from generation to generation with great exactness. The Bunya is remarkable as being the only* hereditary property which any of the aborigines are known to possess, and it is therefore protected by law. The food seems to have a fattening effect on the aborigines, and they eat large quantities of it after roasting it at the fire. Contrary to their usual habits, they sometimes store up the bunya nuts, hiding them in a water-hole for a month or two. Here they germinate, and become offensive to a white man's palate, but they are considered by the blacks to have acquired an improved flavour." (Hill.) Samuel Bennett, quoted by Brough Smyth, mentions that after an indulgence in this exclusively vegetable diet they have an irresistible longing for flesh, and that in order to satisfy that craving cannibalism used to be frequent amongst those tribes who were visitors (for the purpose of eating the Bunya Bunya seeds) of those tribes in whose territory the Bunya Bunya tree grows.

* This is scarcely correct. See *Acacia; Macrozamia.*

Prof. E. Heckel has published an article, "Sur le Bunya-Bunya," in the *Revue des Sciences Naturelles Appliquées*, 1891, which gives an interesting account of its cultivation in Europe and its products. It contains drawings showing the structure and composition of the normal and germinating seed, chemical analyses of the seeds, showing their nutritive value in comparison with peas, beans, &c., together with other information. Prof. Heckel quotes Prof. Schlagdenhauffen as finding between 1 and 2 per cent. of fatty matters both in the endosperm and in the embryo, while Dr. Joseph Lauterer (*Proc. R. S. Queensland*, xi, 46, 1896), in an interesting note on "Bunya Bunya Nuts," finds that they contain "absolutely no fatty oil." These two authors also disagree in regard to the presence of sugar in the nuts.

Queensland.

Podocarpus elata, R.Br. Fruits called by Sydney boys "Plums," "Damsons," or "Cherries."

This fruit, which ripens in autumn, consists of an astringent, aromatic, resinous drupe, egg-shaped, and something like a sloe, sitting upon a fleshy substance of a purplish or damson-colour, which is the "damson." I have measured them up to $\frac{3}{4}$ inch long (they are depressed), and $\frac{7}{8}$ inch in diameter, and they are probably larger. The "sloe" cannot be eaten, but aborigines and small boys are fond of the "damsons," which have no stones, and consist of a pleasant but rather insipid mucilaginous substance, the thin skin being slightly astringent. They rank amongst the best of the indigenous fruits. When ripe they stain the mouth and fingers like black cherries do.

I have measured some (July, 1892) $\frac{15}{16}$ inch broad and $\frac{7}{8}$ inch long.

New South Wales and Queensland.

Podocarpus Drouyniana, F.v.M.

"Bearing a fruit of a purple colour, with a glaucous bloom, about the size of a middling plum; very pleasant to the palate, and eaten by settlers." (Drummond, in Hooker's *London Journ. Bot.*, vii, 180.)

Western Australia.

Podocarpus spinulosus, R.Br. "Native Plum," or "Native Damson."

This shrub possesses edible fruit, something like a plum, hence its vernacular names. The Rev. Dr. Woolls tells me that, mixed with the jam of the native currant (*Leptomeria acida*), it makes a very good pudding. Fruit about half the size of *P. elata*.

New South Wales.

CYCADEÆ.

Bowenia spectabilis, Hook.

The yam-like rhizome is used largely for food by the natives. (Bailey.)

Queensland.

Cycas media, R.Br. "Nut Palm." "Baveu," of Central Queensland aborigines.

Following is Leichhardt's version of the method of preparation of the nuts for food:—"The seeds of Cycas appear to form a considerable part of the food of the natives of Cycas Creek and the Robinson. They are cut in slices and spread over the ground and dried. When brittle they are soaked for several days in water, and afterwards tied up in tea-tree bark, to undergo a sort of fermentation, which destroys their poisonous principle, for in a fresh state they are violently cathartic and emetic."

"Employed by the aborigines as food. An excellent farina is obtained from it. The nuts are deprived of their outer succulent cover (sarcocarp) and are then broken; the kernels, having been roughly pounded, are dried three or four hours in the sun, then brought in a dilly-bag to a stream or pond, where they remain in the running water four or five days, and in stagnant water three or four days. By a touch of the fingers the proper degree of softness produced by maceration is ascertained. They are afterwards placed between the two stones mentioned under *Colocasia macrorrhiza*, reduced to a fine paste, and then baked under the ashes in the same way that our bush people bake their damper." (Thozet.)

Mr. N. Holtze informs me that the nuts, after certain manipulations, are only eaten by the Larrakeeyah tribe of the Northern Territory in their ceremonies of "making" young men.

For another account of their preparation for food by the blacks, see also Palmer, *Proc. R.S. N.S.W.*, 1883, p. 97.

The following notes are interesting; they were written about 1770:—

"We found also the fruits of a low palm called by the Dutch *Moeskruidige Callapus* (*Cycas circinalis*),* which they certainly eat, though this fruit is so unwholesome that some of our people, who, though forewarned, followed their example and ate one or two of them, were violently affected by them; and our hogs, whose constitutions we thought might be as strong as those of the Indians, literally died after having eaten them. It is probable, however, that these people have some method of preparing them by which their poisonous quality is destroyed, as the inhabitants of the East Indian Isles are said to do by boiling them, steeping them twenty-four hours in water, then drying them, and using them to thicken broth, from whence it would seem that the poisonous quality lies entirely in the juices, as it does in the the roots of the mandihoca or cassava of the West Indies, and that when thoroughly cleared of them, the pulp remaining may be a wholesome and nutritious food." (*Journal of the Right Hon. Sir Joseph Banks*, p. 313.)

"The third (*Cycas media*, Br.), which, like the second, is found only in the northern parts, is low, seldom 10 feet in height, with small pinnated leaves, resembling those of some kinds of fern. Cabbage it has none, but generally bears a plentiful crop of nuts, about the size of a large chestnut, and rounder. By the hulls of these, which we found plentifully near the Indian fires, we were assured that these people ate them, and some of our gentlemen tried to do the same, but were deterred from a second experiment by a hearty fit of vomiting. The hogs, however, which were still shorter of provision than we were, ate them heartily, and we considered their constitutions stronger than ours, until after about a week they were all taken extremely ill of indigestion; two died, and the rest were saved with difficulty." (*Ibid*, pp. 299–300).

Queensland and North Australia.

Macrozamia spp.

"The kernels of the nut, after being pounded, macerated, and baked, are eaten by the natives. Curiously enough the original occupants of the soil seemed never to have made use of the copious starch, which can be readily washed out of the comminuted stems of any Cycadaceous plants. All these plants are pervaded by a virulent poison-principle, which becomes inert or expelled by heat." (Mueller.)

* *Cycas media*, Br., closely allied to *C. circinalis*. See pp. 299 and 421, *op. cit.*

In Northern Florida the stems of a Cycad, known as "Koorti" (*Zamia integrifolia*, Ait.), are regularly dug up for the purpose of obtaining the starch they contain, the finished product being an arrowroot of excellent quality. See *American Journ. of Pharmacy, April*, 1898, p. 212.

A large number of *Macrozamias* have been described; the nuts of all possess similar properties. Concerning the following species we have definite information in regard to their use as food :—

Macrozamia Fraseri, syn., *Encephalartos Fraseri*, Miq. "Boyar Palm," of colonists; called "By-yu" by the natives according to Grey. Stokes (*Discoveries in Australia*, ii, 132) gives the colonial name as "Palm-tree," the aboriginal as "Djir-jy" or "Jirjy," and states that the red fruits are called "baio" (? boyar).

The nuts of this plant yield food to the natives. In Grey's Expedition (*Journ. of Two Exped.*, iii, 61, &c.) his party of ten used them. Some members of his party incautiously ate some before they were dry and thus rendered innocuous; "they were seized with violent fits of vomiting, accompanied by vertigo and other distressing symptoms." The practice of the natives was to bury them in small holes in the ground in damp soil, and by this treatment they became fit to eat. At page 296 he gives more detailed information: "The native women collect the nuts in the month of March, and having placed them in some shallow pool of water, they leave them to soak for several days. When they have ascertained that the by-yu has been immersed in water for a sufficient time, they dig, in a dry, sandy place, holes which they call *mar-dak*. These holes are about the depth that a person's arms can reach, and 1 foot in diameter; they line them with rushes and fill them up with the nuts, over which they sprinkle a little sand and then cover the holes nicely over with the tops of the grass-tree. In about a fortnight the pulp which encases the nut becomes quite dry, and it is then fit to eat; but if eaten before that it produces the effects already described. The natives eat this pulp both raw and roasted; in the latter state it tastes quite as well as a chestnut. The process which these nuts undergo in the hands of the natives has no effect upon the kernel, which still acts both as an emetic and cathartic."

Mr. Backhouse (*Narrative*, p. 542) says: "I have heard from persons of respectable authority that in the Swan River country, as well as at King George's Sound, the natives have their private property,* clearly distinguished into hunting grounds, the boundaries of which are definite, trees being often recognised by them as land-marks, and that the possession rests in the head of a family."

Western Australia.

Macrozamia Miquelii, F.v.M., syn. *Encephalartos Miquellii*, F.v.M. "Dwarf Zamia." "Banga," of Central Queensland aborigines.

Found generally in the same locality as *Cycas media*, with a large cone fruit not unlike a pineapple. The seeds, orange-red when ripe, and separating freely, are baked for about half an hour under ashes. The outside covers and stones are then broken, and the kernels, divided by a stroke of the *Kondola*, are put into a dilly-bag and carried to a stream or pond, where they remain six or eight days before they are fit for eating. (Thorzet; see also E. Palmer.)

Queensland.

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* See *Araucaria Bidwilli*, p. 734.

Macrozamia Perowskiana, Miq. (Syn. *Encephalartos Denisonii*, F.v.M.) Burrawong, Ab. name; "Channing Nut," "Blackfellows' Potato," local names on Tweed.

These seeds grow in a cone very much resembling a pineapple. The cones often contain as many as 100 nuts. The plant grows much like a tree-fern, with very dark-green leaves, sometimes 5 or 6 feet in length, with a naked stalk which grows to a height of 10 feet from the ground and about 8 inches in diameter. Grows chiefly in barren, forest country.

Very plentiful in Tweed district. (F. R. Pope, Murwillumbah.)

"Within our own memory three boys were poisoned at Springsure by eating the nuts of a Cycadaceous plant, probably *M. Perowskiana*." (O'Shanesy, *Contrib. to Flora of Qd.*, p. 54.)

New South Wales and Queensland.

Macrozamia spiralis, Miq. (Syn. *Zamia spiralis*, R.Br.; *Encephalartos spiralis*, Lehm.), "Burrawang Nut."

The nuts are relished by the aborigines. An arrowroot of good quality is obtained from them.

Governor Phillip very early observed that this plant formed part of the diet of the Port Jackson natives. His account refers also to a fig, probably *Ficus rubiginosa*:—

"Among the fruits used by them (blacks between Port Jackson and Botany Bay) is a kind of wild fig; and they eat also the kernels of that fruit, which resembles a pineapple. The latter, when eaten by some of the French seamen (La Perouse's men), occasioned violent retchings; possibly the natives may remove the noxious qualities by some process like those employed upon the cassada." (Philip's *Voyages*, London, 1789, p. 135.)

For an account of the use of these fruits for food by the Newcastle blacks, see *Extract from the letters of James Backhouse*, Third Part, p. 64.

This species is found in enormous numbers in the poor sandstone country between Nelligen and Braidwood and other places in the southern part of the Colony. The quantity of nuts produced by these plants is simply prodigious; they contain a useful starch, but this is rarely utilised. The starch is occasionally exhibited at various Agricultural Shows. For instance, on one occasion at one show at Braidwood there was exhibited quite a large quantity of this farina, some 50 lb. weight, which could not be distinguished by appearance from the arrowroot ordinarily sold in the shops.

The exhibitor stated that his family were in the habit of using it daily, and had done so for years, and had found it very nutritious. He crushed the nuts in some homely fashion, and allowed the starch to settle in large tubs of pure water, after which it was spread out to dry.

Pigs have been known to eat the raw nuts without apparent injury, notwithstanding that so much is said about their poisonous properties in that condition. Pecks of the seeds have been often found stored up by some animal in hollow logs, showing that animals subsist upon them during winter.

New South Wales and Queensland.

SCITAMINEÆ.

Amomum Dallachyi, F.v.M.

The arillus surrounding the seed has a pleasant flavour, somewhat resembling the pulp in which the seed of a passion-fruit is embedded. (*Cat., Qd. Exhibits, C.I.E.M.*)

Queensland.

ORCHIDEÆ.

Caladenia spp. "Spider Orchids."

These and other orchids have edible tubers.
Throughout Australia.

Cymbidium albuciflorum, F.v.M. Native, Cairns District, "Pongeum." (Bailey.)

The blacks use the pseudo-bulbs for food.
New South Wales and Queensland.

Cymbidium canaliculatum, R.Br. "Dampy-ampy" of Port Curtis (Q.) blacks. "Native Arrowroot" of the whites.

"The only orchid of the interior of tropical Australia which affords mucilaginous food." (Mueller.)

E. Palmer (*Proc. R.S., N.S.W.*, 1883, p. 97) draws attention to the use of the pseudo-bulbs of this plant as food by Queensland blacks.

Mr. C. Hedley (*Proc. R.S., Qd.* v) states that if the pseudo-bulbs be grated up and boiled a substance closely resembling arrowroot is obtained, and that delicate children have been reared on this when accidents have cut them off from other supplies. He also states that the fruit and pseudo-bulbs will also support life if chewed raw; it might therefore be a useful plant to a man lost in the bush.

South Australia, New South Wales, Queensland, and Northern Australia.

Cyrtostylis.

Baron Mueller states that the aborigines of Victoria used to feed on the tubers of these orchids.

Dendrobium canaliculatum, R.Br. "Yamberin," of the Queensland aborigines.

"The bulbous stems, after being deprived of the old leaves, are edible." (Thozet.)

Queensland.

Dendrobium speciosum, Smith. "Rock Lily."

The large pseudo-bulbs have been eaten by the aborigines; they, however, contain but little nutritive matter.

Kangaroo rats and bandicoots feed on the pseudo-bulbs of this and several other (perhaps many) orchids. I have in one district seen them eat *D. Kingianum* and *Liparis.*

Victoria, New South Wales, and Queensland.

Dipodium.

The tubers of this genus of terrestrial orchids were used as food by the aborigines of Victoria. (Mueller.)

Diuris.

The aborigines of Victoria used to feed on the bulbs of these orchids. (Mueller.)

They are so used in New South Wales and doubtless in other colonies.

Gastrodia sesamoides, R.Br. "Native Potato," of parts of Tasmania.

The tubers were roasted and eaten by the Tasmanian natives. These tubers grow out of one another, and are of the size, and of nearly the form of kidney potatoes; the lowermost is attached by a bundle of thick, fleshy fibres to the root of the tree from which it derives its nourishment. Mr. R. C. Gunn described the taste of them as somewhat resembling beetroot, but they are watery and insipid.

All the colonies except South and Western Australia.

Geodorum pictum, Lindl. "Yeenga," of Gladstone (Q.) blacks; "Uine," of those of Rockhampton. (Hedley.)

Mr. C. Hedley (*Proc. R.S., Qd.*, v.) states that the tubers of this terrestrial orchid are eaten by the blacks about Gladstone.

Queensland and Northern Australia.

Glossodia.

Baron Mueller states that the aborigines of Victoria used to eat the tubers of these orchids.

Lyperanthus.

Baron Mueller states that the aborigines of Victoria used to feed on the tubers of these terrestrial orchids.

Microtis.

The aborigines of Victoria used to feed on the bulbs of these orchids. (Mueller.)

Prasophyllum.

The aborigines of Victoria used to feed on the bulbs of these orchids. (Mueller.)

In New South Wales also.

Pterostylis.

Baron Mueller states that the aboriginals of Victoria used to eat the bulbs of these orchids.

In New South Wales also.

Thelymitra.

The aborigines of Victoria used to feed on the bulbs of these orchids. (Mueller.)

In New South Wales also.

HÆMADORACEÆ.

Anigozanthus flavida, Rea.

The natives use the tuberous roots for food, selecting such as are going to flower the following year. These contain a considerable quantity of starch, and are of about the size of the roots of the Florentine Iris.

Western Australia.

Hæmodorum spicatum, R.Br. "Mean," of the aborigines.

This is doubtless the plant referred to by Mr. Backhouse (*Narrative*, p. 527) in his account of the foods of the blacks of King George's Sound. The long bulb is poor fare, occasioning their tongues to crack grievously; it is prepared for eating by being roasted and beaten up with the earth from the inside of the nest of the white ant, or with a red substance found on burnt ground.

(*To be continued.*)

Some further Observations on Protective Inoculation against Tick-fever.

Dr. Frank Tidswell, Principal Assistant Medical Officer of the Government, to whom has been entrusted the conduct of investigations to determine the degree and duration of immunity from Tick-fever arising from the inoculation of cattle with "recovered" or "virulent" blood, has submitted a further memorandum respecting his experiments.

In submitting Dr. Tidswell's report to the Right Honorable G. H. Reid, P.C., the Chief Medical Officer of the Government, Dr. Ashburton Thompson, says:

Sir,

In his first report on protective inoculation against Tick Fever the Principal Assistant Medical Officer of the Government (Dr. Frank Tidswell) pointed out among other things—

(*a*) that inoculation gave protection against a second attack of illness when the attempt to excite it was made within a few weeks of recovery from the first attack;

(*b*) that the protection afforded by a single attack was transitory whether it had been excited by inoculation or by exposure to virulent ticks in the field; and

(*c*) that the approximate duration of the protection given by a single attack had never been fixed.

The present communication is made in continuation of that report, and constitutes a contribution to study of the duration of conferred protection. By arrangement with the Government of Queensland, three cows which had suffered from inoculated tick-fever at the Experimental Station at North Head were sent to Rockhampton, and were there exposed to attack by virulent ticks. They were placed under supervision of Dr. Sidney Hunt, who kept a record of the symptoms they subsequently showed; for they all fell ill, and one of them would have died had it not been killed to end its sufferings when its recovery had clearly become hopeless. As soon as the experiment had been completed Dr. Hunt's record was transmitted to Sydney. It is this record which Dr. Tidswell now discusses and interprets in the paper which I have the honor to present herewith, and which, I venture to suggest, might be communicated to the Honorable the Minister for Mines and Agriculture.

2. The facts are as follows:—The three cows were inoculated at the Experimental Station with 10 cc. of virulent blood apiece, and in consequence all of them had a sharp attack of tick-fever. After recovery had either become complete or had well set in, each was put to the test of further inoculation with a very large quantity of virulent blood (100 cc. in two cases, 50 cc. in one case); and at the

same time 10 cc. of the same blood was injected into a clean cow. The clean cow suffered smartly from tick-fever, but the test inoculation produced no appreciable effect on the three inoculated cows. Thus it was shown that the inoculated cows had been protected against tick-fever by the primary inoculation, and that they were insusceptible to a further attack of the inoculated disease at the date of the test inoculation. Just three and a half months later the three inoculated and tested cows were turned out in a paddock known to be infested with virulent ticks. In the course of a few days they became covered with young ticks "in enormous numbers," and it appears from Dr. Hunt's record that after the interval between exposure and illness, which is usual, all three had fever (though in one case it was slight). The fever probably endured for about the usual number of days (though not so long in that cow which had the slighter degree of it). During, or directly after the fever all three showed the characteristic sign of tick-fever, namely, rapid and extensive destruction of the red corpuscles of the blood. The cow which died of this illness had albuminuria. In the other two recovery set in at about the time usual after non-fatal attacks. Such a train of symptoms, following such a course under such circumstances, fully depicts tick-fever. None of the three cows had red-water, and the spleen of the one which died was not enlarged; but these signs are far from being constant.

3. Judging from precisely the same set of observed facts, Dr. Hunt has suggested that these three cows may have suffered, not from tick-fever, but from what is often referred to in Queensland as "tick-poverty," or "tick-irritation." He has not expressed this view in decided terms, nor has he attempted to support it earnestly. And, in fact, since a sufficient cause of the illness witnessed is demonstrable from his own record, incomplete though it be, to seek another is superfluous. But there is this special objection to the alternative cause thus suggested by him: It is that nothing exact is known of the effects (if any) which are produced on the ox by the cattle-tick as a tick, and apart from its intermediary function of host and carrier of the organism which causes tick-fever. It is probable, no doubt, that *Ixodes bovis* (or *Böophilus bovis,* as it is sometimes named) may produce some ill-effects; and it might do so in one or all of the three following ways:—It might, perhaps, elaborate a poison; if it do so, it might inject it, and possibly the injected poison might take direct effect on the ox. Secondly, when the animal is infested by it in enormous numbers, the innumerable small wounds inflicted on the hide may do harm indirectly by irritating the skin, and by hampering its natural function; for over large areas the punctures are usually so numerous that no healthy skin can be seen, and the hide is quite spoilt for tanning. Lastly, it is just possible that abstraction of blood by the tick may cause some contributory harm; although, when the extremely small quantity which each tick can take, and take but slowly, is contrasted with the large quantities which may be abstracted from the ox at one bleeding without producing any manifest effect, it seems improbable that this factor can have any practical importance. These three contingencies, then, are likely enough to be realised in some

degree; they deserve, or even demand, investigation. But thus far nothing concerning them is known, except, indeed, that both naturally and protectively inoculated cattle most often suffer infestation with indifference; and, therefore, for the present at least, "tick-poverty" or "tick-irritation" cannot be regarded as a clearly recognisable condition.

4. The three cows, then, which had been protectively inoculated at the Experimental Station, suffered from tick-fever on exposure to virulent ticks three and a half months after they had received the test inoculation which proved that they had really been protected. One, which had been protectively inoculated five months before exposure, had a severe attack; and of the two which had been so inoculated four and a half months before such exposure, one had a mild, the other a fatal attack. Whether the test inoculation can be regarded as having reinforced the effects of the protective inoculation is not yet quite clear. It seems probable, however, that the protection afforded is in the nature of tolerance, rather than of that which is commonly understood by immunity. This is not the place in which to discuss the bearing of the difference just indicated, but it is of great importance in relation to the practical use of protective inoculation. Much patient observation and research on carefully-planned lines are still necessary to elucidate the nature of the protection which inoculation can afford, its duration, and the conditions under which it passes off or is maintained.

5. The following provisional statements are warranted by present knowledge, at a time when some practical guide is urgently required by stock owners on the northern frontier near the coast:—

(*d*) Protective inoculation is a valuable precaution against fatal tick-fever.

(*e*) The protection it affords is not durable, but transitory; it passes off at different dates in animals inoculated at the same time.

(*f*) It is most serviceable when it can be soon followed by continued exposure to the attacks of virulent ticks.

(*g*) (i) If done long before continued exposure to virulent ticks becomes possible, it must be repeated. The interval which may be safely allowed to elapse cannot be fixed for the present. In view of the need for some advice on this head, and of the expense and difficulty of inoculating large herds, six months may be mentioned as an interval which probably should not be exceeded.

(ii) If experience shows that the march of the tick can be safely watched until it has got close, then, perhaps, inoculation might be deferred with a view to doing it but once. But, at the best, this course must be full of risk. In face of a probable calamity, the practical rule should be to inoculate when the tick has arrived within 30 or 40 miles, and to be prepared to reinoculate not more than six months later at most, if, by that time, the tick has not reached the threatened herd.

I have, &c.,

J. ASHBURTON THOMPSON,

Chief Medical Officer of the Government.

Memorandum upon some further Observations on Protective Inoculation against Tick-fever.

As may be seen by reference to the note attached to my Report on Protective Inoculation against Tick-fever, the general plan of experiment followed by us was "to inject the animals with either recovered or virulent blood, * * * and later on inject virulent blood to test the immunity" (page 14). In Part 2, section (*d*), of the same report, details are given concerning the injection and reinjection of the animals treated. It was found in all cases that when the first or protective injection had produced a reaction, the second or test injection failed to produce another; "the first reaction had completely immunised the animals against reinoculation, even with the very large doses which represent the severest trial we could apply in this Colony." In view of certain theoretical considerations which need not be specified here, these results having to do with artificially induced tick-fever, were not considered to be of decisive application to tick-fever naturally acquired from ticks, and the report goes on to say that "the ultimate test of exposure to ticks is to be carried out by sending some of the animals to Queensland."

This ultimate test has now been effected under the direction of Dr. Sidney Hunt, to whose care three animals of our series were consigned in February last. In submitting my commentary on the results reported by Dr. Hunt, I take the opportunity of again calling attention to the defective nature of our knowledge concerning the duration of the immunity conferred by protective inoculation.

(2.)

The three animals dealt with in this memorandum were inoculated at North Head during our experiments, and subsequently sent to Rockhampton, where, as Dr. Hunt's report tells us, "they were at once placed in a well-grassed and watered paddock, which is known to be grossly infested by virulent ticks (about forty (40) of sixty (60) head of cattle kept in this paddock are reported to have died of Texas Fever)." The essential data concerning the animals in question are given in the attached table, pages 752–3; those referring to the inoculation being taken from my report, and those referring to the results of exposure to ticks being taken from Dr. Hunt's report. Briefly, the histories of the three animals are as follow:—

Cow VI (No. 1 of Dr. Hunt's Report).

When first coming under our observation this animal was in a poor condition, but showed no evidences of actual illness. She did not react to the tuberculin test, took her food well, gave a fair quantity of milk of good quality, and her pulse, temperature, respirations, urine, blood appearances, &c., were perfectly normal.

On July 23rd, 1898, she was injected with 10 cubic centimetres of filtered normal serum, which was without effect on her health.

On September 22nd, 1898, she received her protective inoculation of 10 cubic centimetres of virulent tick-fever blood. As a consequence

she passed through an attack of tick-fever, indicated amongst other symptoms by fever and blood destruction. (See attached table.) She made a good recovery.

On October 23rd, 1898, she received her test injection of 100 cubic centimetres of virulent tick-fever blood, but showed no reaction. The same blood produced reaction in a control cow. (See my report, page 4.)

In February, 1899, she was sent to Rockhampton and exposed to ticks. Dr. Hunt's observations show that she became infested with ticks in enormous numbers, developed marked fever, had a blood destruction of much greater extent than that which followed her inoculation, lost condition, and became sick and weak. (See attached table.) At the date of report she had begun to show signs of recovery.

Cow VIII (No. 2 of Dr. Hunt's Report).

When first coming under our observation this animal was in medium condition and quite healthy. She did not react to the tuberculin test, took her food well, gave a very moderate amount of milk of good quality, and her pulse, respiration, temperature, urine, blood appearances, &c., were perfectly normal.

On September 10th, 1898, she received an injection of the supernatant serum obtained by centrifugalising tick-fever blood. This was without obvious effect on her health.

On October 3rd, 1898, she received her protective inoculation of 10 cubic centimetres of virulent tick-fever blood. As a consequence she passed through an attack of tick-fever, indicated, amongst other symptoms, by fever and blood destruction. (See attached table.) She made a good recovery.

On October 23rd, 1898, she received her test injection of 100 cubic centimetres of virulent tick-fever blood, but showed no reaction. The same blood produced reaction in a control cow. (See my report, page 4.)

In February, 1899, she was exposed to the ticks at Rockhampton. Dr. Hunt's observations show that she became infested with ticks in enormous numbers, developed marked fever, had excessive blood destruction, became very sick, progressively weaker, and finally reached a dying condition, in which she was killed. (See attached table.) The principal *post-mortem* findings were—numerous hydatid cysts in the lungs and liver, dark-coloured thick bile, thin and watery blood, very yellow fat round the kidney, dark-coloured albuminous urine in the bladder; whilst on the other hand, the spleen was not enlarged, and the tick-fever parasites were not detected in blood from the heart, kidneys, and spleen.

Cow X (No. 3 of Dr. Hunt's Report).

When first coming under our observation this animal was in poor condition, but quite healthy. She did not react to the tuberculin test, took her food well, gave a fair quantity of milk of good quality, and her pulse, respirations, temperature, urine, blood appearances, &c., were perfectly normal.

On October 3rd, 1898, she received her protective inoculation of 10 cubic centimetres of virulent tick-fever blood. As a consequence

she passed through an attack of tick-fever, indicated, amongst other symptoms, by fever and blood destruction. (See attached table.) She made a good recovery.

On October 23rd, 1898, she received her test inoculation of 50 cubic centimetres of virulent blood, but showed no reaction. The same blood produced reaction in a control cow. (See my report, page 4.)

In February, 1899, she was sent to Rockhampton and exposed to the ticks. Dr. Hunt's observations show that she became infested with ticks in enormous numbers, developed slight fever, and had a marked blood destruction. There is no evidence of any other ill-effects. At the date of report she had begun to show signs of recovery.

From the foregoing sketch it will be seen that in all three animals the conditions of successful protective inoculation were fulfilled. There was a "reaction" such as to protect against subsequent inoculation with virulent tick-fever blood. Yet when exposed to ticks a few months afterwards all three animals become sick, No. X slightly but definitely, No. VI markedly, and No. VIII so severely as to cause death. The onset, symptoms, course, duration, and issues indicate that the sickness was tick-fever. It is quite true, as Dr. Hunt points out, that certain features of tick-fever were not exhibited. In my judgment this does not seriously affect the diagnosis, but since the points have been raised, some discussion of them appears to be necessary.

(3.)

It is pointed out that in cow No. 2 (VIII of our series) there was no red-water during life, the spleen was not found enlarged after death, and the tick-fever parasites were not detected in blood from the heart, spleen, or kidneys.

Now neither splenic enlargement nor red-water are constant accompaniments of tick-fever. When they are present they are probably both developed as the result of the same pathological process, viz., that underlying the disposal of the hæmoglobin liberated by the destruction of the blood corpuscles; so that the absence of both together is not surprising. The absence of red-water from Nos. 1 and 3 is equally void of significance. In cow 2, the urine found in the bladder after death contained a large amount of albumen, and this condition is a usual accompaniment of tick-fever. In these facts there is as much in favour of as against tick-fever.

The negative result as regards tick-fever parasites is less important than would appear at first sight. The value of the microscope for diagnostic purposes has its limitations. It is an instrument of very great precision when its revelations are positive, but for various reasons negative observations are nearly always of questionable interpretation. In another disease of cattle, viz., tuberculosis, the causal micro-organisms cannot always be demonstrated microscopically in lesions which are undoubtedly caused by them, but one does not on that account exclude tuberculosis. The non-discovery of the tick-fever parasites cannot be allowed any greater weight as evidence against a diagnosis of tick-fever. It is certain that the parasites

were present in the blood of this cow at the time she passed through her inoculation fever at North Head. This is recognised by Dr. Hunt in another part of the report, in which he argues that injection of blood from this cow would not have contributed to the diagnosis owing to her previous inoculation. In this I concur, and at the same time I would point out that the detection of the parasites in her blood would not have settled the question either, and for the same reason. The certainty of their previous presence deprives their non-detection of the significance which otherwise might have attached to it. The incident merely serves to emphasise the well-known fact that the parasites are not always discoverable in genuine cases of tick fever. This is not to be wondered at, for we are as yet in the dark concerning the life history of the parasite. We are not certain that they do not assume forms in the bodies of their hosts other than those with which we are already acquainted; besides which the behaviour and distribution of the known forms at different periods of the illness still remains unascertained. On the other hand, we do know that tick fever can be set up by the injection of blood in which not a single parasite can be detected by microscopical examination. In view of these considerations, it is unsafe to dogmatise concerning the parasites, and their non-detection certainly cannot be accepted at the present time as valid evidence against a diagnosis of tick-fever. Indeed, neither the presence nor absence of the parasites can have any bearing upon the case in review; under the conditions of this experiment the microscopic test is inapplicable.

It is suggested that the illness from which our animals suffered may have been due to the "direct effects of sudden and gross infestment of ticks." The points submitted in favour of this view are as follow:—

1. Cow II, in which the disease was fatal, was more grossly infested with ticks than the other two, and the severity of her illness "seemed to be proportionate to the number of ticks upon her."
2. The general appearance of the animals was more suggestive of "tick-poverty" than tick-fever.
3. The anæmia from which the animals suffered "cannot in itself be regarded as distinctive evidence of tick-fever" since a similar condition was noted in the Boolburra cattle, "which were certainly not contaminated with the Texas fever organism."

Concerning the extent of tick infestation, the only statements are that all the animals became "infested with young ticks in enormous numbers," and that later they were "very grossly infested with fully developed ticks," and that cow No. II was "even more grossly infested than the others." I need scarcely say that I accept these statements without question, but they do not reveal the grounds upon which Dr. Hunt bases his opinion as to the relationship between the degree of illness and the number of ticks. Lacking explanation of the means of comparison, the assertion of the "proportionate" severity must necessarily fail to be a convincing argument. Further, the very marked differences in severity between cows VI and X are not explainable on the hypothesis that ticks alone were responsible for the illness.

Concerning point 2 and point 3, in so far as it relates to the Boolburra cattle, I have nothing to say, since in the absence of particulars they are beyond the reach of my criticism. I agree that anæmia in itself is not indicative of tick-fever. I would point out, however, that the anæmia was not "in itself," but associated with fever and sundry other conditions that go to make up the symptom complex of tick-fever. Moreover, the anæmia was of that extreme degree which is specially characteristic of tick-fever. It would appear also that the course of the anæmia was such as usually occurs in tick-fever, although the incompleteness of the report prevents insistence on this point.

Of the three contentions just discussed, the first two are matters of opinion, and albeit the opinion of one very conversant with the subject, still they are mere opinions. The third alone is entitled to rank as a fact, and as such it is good evidence in favour of tick-fever. Hence, it is clear that the ticks must be exonerated from sole responsibility for the illness. It is probable that they had some influence, but how much cannot be gauged, since we are not yet in possession of precise information concerning the direct effects of ticks. But this aspect of the tick question has already been sufficiently discussed in my report. (Page 5.)

There are two further points raised which might appear to affect the conclusiveness of the experiment, viz., the existence of hydatids in cow II, and the absence of controls.

The hydatids found in the lungs and liver of cow II are more than once referred to as evidence that the animal was "not a healthy or normal one." Undue stress must not be attached to this very common and unimportant condition. The hydatids must be absolutely excluded as a cause of death; they practically never cause death in cattle. Since they are of very slow growth, they could not possibly be responsible for the acute illness from which the cow suffered, and in any case could not have produced the symptoms she exhibited. They could not even have had much effect as a debilitating factor, for it is to be remembered that the animal was not taken at random, but selected from a series that had been under very strict observation for many months previously, and our detailed records, in part given in the attached table, show that to all intents and purposes she was perfectly healthy when sent to Rockhampton.

As regards the second point, the statement is that "it is to be regretted from the experimental standpoint that an equal number of uninoculated animals were not sent up from New South Wales as controls." The arrangement for this experiment was that the cattle should be exposed in just such a place as that prescribed, viz., "a paddock known to be grossly infested by virulent ticks, &c." (*vide supra*). Scientific accuracy does not require, and due regard for economy and animal life prohibit, the use of controls under such circumstances. Hence, controls were deliberately omitted from this experiment as unnecessary, and the issue has perfectly justified this decision.

(4.)

The various comments just considered were wisely made by Dr. Hunt, as indicating the various factors which might have been operative in

producing illness in our cows. They are such as merit attention; but after having fairly stated and discussed them, I conclude that neither singly nor collectively do they militate against a diagnosis of tick-fever. On the other hand, the results taken as a whole seem to show beyond question that our cows suffered from tick-fever. The animals were placed in contact with, and became infested by, ticks, whose capability of producing tick-fever was only too well known by previous experience. After the proper incubation interval they suddenly fell sick, and exhibited the symptoms of tick-fever. The febrile reaction lasted the usual period; there was a typical blood destruction, and the other effects apparently followed the usual course. At the date of report one animal had died in just the way death occurs in tick-fever, and the other two appeared to be on the verge of convalescence. It seems to me that no clearer evidence can reasonably be asked for, nor in any practicable way obtained. For my part I do not doubt that the animals had tick-fever. I am willing to admit that the ticks may have helped, because I am not in a position to exclude their influence, and because it is likely that they may have some effect of their own, although the exact nature of it has not been determined. I agree with Dr. Hunt in thinking that what is understood by "tick-poverty" is an "altogether different matter" from tick-fever, and I venture to believe that the difference between them will become more decidedly marked with increase of our scientific acquaintance with the direct effects of ticks. I make this comment with some diffidence, as my personal knowledge of ticks is not sufficient to enable me to speak with perfect confidence concerning them. But the case stands otherwise as regards tick-fever. I have been able to study this disease by itself, *i.e.*, separate from the complicating influences of ticks, and it is upon extensive observations on its symptoms and pathology that I base my opinion as to the nature of the illness from which our cows suffered in Queensland. The disease picture of tick-fever is very fully exhibited by them, and I think it unwise to attribute to a hypothetical "tick-poverty" that which clearly belongs to tick-fever.

As to whether the experiment can or "cannot be regarded as an unequivocal instance in which inoculation has failed to do that which is claimed for it—viz., to protect against Texas fever," this depends on the exact extent of such claims. Although I do not doubt that our cows suffered from tick-fever, I do not consider that the just claims of the method are upset on that account. On the contrary, if these three animals did not suffer from tick-fever, then the efficacy of protective inoculation would be open to serious question. For the only alternative diagnosis is "tick-poverty"; and if the direct effects of ticks can produce an outcome indistinguishable from tick-fever, wherein lies the value of protective inoculation? A sensible man would surely not go to the trouble of inoculating his herds in the face of such possibilities as the result of a condition ("tick-poverty") against which inoculation affords no protection whatever.

But the results are not to be interpreted as evidence against protecive inoculation; they merely help towards the very necessary delimitation of its real value. I would here call attention to certain portions of my

report, which show that these very results were anticipated at the same time that the value of protective inoculation was asserted. On page 2 of my report there is a table, showing that immunity from tick-fever is not completely conferred by a single attack; and on the same page it is pointed out that immunity, even if perfectly acquired, as in Texas cattle, is liable to be lost again after an interval of freedom from reinfection. On page 6, in referring to the immunity conferred by protective inoculation, it is mentioned that the duration of this immunity has not been definitely ascertained; but with the American observations as a guide, it is stated that "it may be assumed that the immunity will last a year or two at least, but that it will vary in different animals." Finally, the matter is again brought under special notice in the conclusion to my report in the following terms:—

"We have seen that immunity against tick-fever only becomes complete and lasting as the result of repeated infection. As satisfactory and durable immunity is not secured by a single attack of the natural disease, so the protection of cattle is not finally effected by a single inoculation. The condition of acquired immunity is an artificial one, and the tendency in all such cases is to reversion to the natural state. It is to be expected that the acquired immunity of cattle to tick-fever, in the absence of reinfection, will gradually become lessened as time goes on."

I feel no compunction in repeating these statements, for I do not think that the aspect they deal with has received the amount of attention its importance deserves. The question of the duration of the immunity is of paramount practical significance to the stock-owners of this Colony, and it is just the point upon which evidence was found wanting. It was perceived that further information about it was necessary, and the experiment discussed in this memorandum formed one of the lines along which its investigation was directed. The results are to be interpreted in view of this object, and the proper inference to be drawn from them may now be stated.

After recovery from the effects of an inoculation, which conferred protection against reinoculation, the three animals were allowed to remain free from reinfection until sufficient time had elapsed to permit of some reversion to their naturally susceptible condition. After three months they were sent to Queensland, and exposed to ticks. All three had tick-fever in consequence, but the severity was different in each. No. VIII acquired an illness, which led to her death, and the inference is that she had completely lost her previous immunity. No. VI suffered severely, but recovered, and she may or may not have retained some immunity. No. X seems to have retained considerable immunity since she suffered little constitutional disturbance as the result of her illness.

It will be seen now that the experiment was well adapted to the purpose for which it was planned. We know from abundant experience that inoculation will protect if performed shortly before exposure to ticks, and its value is, in so far, assured. But there is no reason to suppose that it will confer an everlasting immunity. There is no disease which bestows a permanent immunity upon all who recover

from its attack, and in most diseases the acquired immunity present at first becomes progressively weaker with lapse of time until it is finally lost again. The period required for this reversion to the naturally susceptible condition differs with different diseases, and has to be determined in each case by experience or experiment. It is fallacious to rely upon our knowledge of immunity after bacterial diseases for more than a very general indication of the direction to be followed in inquiring into the possibility of the same condition after tick-fever. The bacteria are vegetable parasites, whilst the tick-fever micro-organisms belong to the animal kingdom, being classified amongst the protozoa. For no other disease-producing protozoan has immunity been established, and this in itself sufficiently indicates the need for careful investigation. In view of the evidence set forth in my report, it was concluded that the duration of such immunity as apparently exists after tick-fever was to be measured by months rather than by years, and hence a trial of it was made at the earliest period capable of affording decisive results. The issue is to the effect that the immunity may have a very short existence in some cases, and it clearly confirms the opinion expressed in my report that its duration "will vary in different animals."

(5.)

It is still impossible to fix any limit to the duration of the immunity after inoculation. The question is not one that can be decided off-hand. Its settlement is not as easy of accomplishment as might be expected. The efficiency of the primary inoculation, the degree of reaction, the number of reinoculations, and their effect, the persistence of the parasites in the blood, possible differences between virulent and recovered blood, and the age, sex, and condition of the animal operated upon, are some of the more important complicating influences which must receive detailed attention before the final answer can be given. We really know little about them as yet. As the Chief Medical Officer has said, the present plan of protective inoculation stands much in need of scientific investigation.

Towards this investigation the present experiment is but a single contribution, and must be weighed accordingly. It is only a tentative effort—a "feeler" put forth into darkness. But its results furnish, at least, a warning of which it would be wise to take heed. They show that whilst a single operation, *i.e.*, the protective and test inoculations taken together, may serve to protect some animals for a period of four months (witness cow X), it will not suffice for all (witness cows VI and VIII). Hence, it would be foolish for us in this Colony to place implicit reliance on a single operation as a means of securing a durable immunity. All available evidence points to this—that the protection must not only be obtained, but maintained. Once more I venture to quote from my report, in order to emphasise the advice therein given, viz.:—"The immunity conferred by the first inoculation should be supplemented by systematic re-inoculation according to some definite plan until the arrival of the ticks makes it no longer necessary."

FRANK TIDSWELL,

Principal Assistant Medical Officer of the Government.

TABLE showing Records of Observations on Cows VI, VIII, and X.

Data concerning Cow VI. No. 1 of Dr. Hunt's Report.

Date.	Notes.	Temperature. M.	Temperature. E.	Red blood corpuscles, millions per C.M.
1898. July to Sept.	Before inoculation ..	101·3 103·2	101·4 102·9	.. 5·5
Sept. 22	Inoculated. 10 cc. Animal in medium condition, but showing no signs of ill-health. Did not react to tuberculin test. Takes food well; ruminates; fair milker.	..	..	..
„ 23	....	102·4	102·1	5·6
„ 24	....	104·4	102·0	5·7
„ 25	....	102·3	102·0	5·6
„ 26	....	102·0	101·9	5·3
„ 27	....	102·4	102·0	5·5
„ 28	....	101·9	102·2	5·5
„ 29	....	102·4	102·0	5·7
„ 30	....	102·3	102·1	5·6
Oct. 1	....	102·5	101·8	5·7
„ 2	....	102·3	102·4	5·5
„ 3	Beginning of febrile reaction. Animal not so bright; milk yield falling off.	103·2	103·7	5·8
„ 4	....	103·6	103·6	5·8
„ 5	....	103·2	103·6	5·4
„ 6	Not eating well. Milk yield fallen to about ⅓ normal.	105·2	106·2	5·1
„ 7	....	106·3	104·7	4·6
„ 8	Ruminates. End of febrile reaction.	104·3	104·0	4·2
„ 9	Taking more food. Milk yield improving.	102·8	102·6	4·4
„ 10	....	102·6	102·0	4·3
„ 11	....	102·6	102·4	4·2
„ 12	....	102·4	102·3	4·5
„ 13	Apparently recovered ..	102·8	102·3	5·1
„ 14	....	102·6	102·3	5·1
„ 15	....	102·6	102·4	5·6
„ 16	....	102·6	102·3	5·4
„ 17	....	102·5	102·3	5·3
„ 18	Continues well	102·4	102·5	5·2
„ 19	....	102·7	102·5	5·1
„ 20	....	102·3	102·5	5·1
„ 21	....	103·2	102·7	5·2
„ 22	....	103·2	102·4	5·3
„ 23	Reinoculated. 100 cc. No reaction followed.	102·4	102·5	5·4
„ 24	....	102·7	103·2	5·5
„ 25	....	102·8	102·3	5·6
„ 30	....	102·8	102·3	5·5

Data concerning Cow VIII. No. 2 of Dr. Hunt's Report.

Date.	Notes.	Temperature. M.	Temperature. E.	Red blood corpuscles, millions per C.M.
1898. Sept. to Oct.	Before inoculation ..	101·1 102·1	101·3 102·7	.. 5·6
Oct. 3	Inoculated. 10 cc. Animal in medium condition. Shows no signs of ill-health. Did not react to tuberculin test. Takes food well; ruminates; poor milker.	..	..	..
„ 4	....	102·0	101·5	6·0
„ 5	....	102·0	101·5	5·9
„ 6	....	101·9	101·9	5·9
„ 7	....	102·8	103·2	5·9
„ 8	....	102·0	103·4	5·9
„ 9	....	103·4	102·8	5·8
„ 10	Beginning of febrile reaction	105·1	106·1	5·7
„ 11	....	104·2	105·8	5·6
„ 12	....	104·8	105·6	5·2
„ 13	Not taking food well; ruminates; slight falling off of milk yield.	103·7	103·6	4·5
„ 14	....	105·6	105·0	4·1
„ 15	....	105·3	105·9	3·8
„ 16	End of febrile reaction ..	104·5	102·9	3·7
„ 17	Taking more food	101·8	102·1	3·9
„ 18	....	101·2	101·3	4·1
„ 19	Eating well. Milk yield improving.	101·1	101·1	4·3
„ 20	....	101·3	101·3	4·1
„ 21	....	101·9	101·6	4·7
„ 22	Apparently recovered (v. blood).	101·9	100·8	4·9
„ 23	Reinoculated. 100 cc. No reaction followed.	101·9	101·7	4·6
„ 24	....	101·8	101·1	4·9
„ 25	....	100·4	101·3	5·2
„ 26	....	101·1	101·0	4·9
„ 27	....	100·2	101·4	4·8
„ 28	....	102·7	100·6	4·9
„ 29	Continues well, and giving full milk (*i.e.*, as much as before inoculation).	101·1	101·8	5·1
„ 30	....	101·9	101·6	5·2
„ 31	....	101·9	101·7	5·1
Nov. 1	....	101·6	101·8	5·1
„ 2	....	101·7	101·9	5·1
„ 3	....	101·8	102·1	5·1
„ 4	....	101·1	101·3	5·1
„ 8	....	101·2	101·6	5·5

Data concerning Cow X. No. 3 of Dr. Hunt's Report.

Date.	Notes.	Temperature. M.	Temperature. E.	Red blood corpuscles, millions per C.M.
1898. Sept. to Oct.	Before inoculation ..	102·1 102·4	102·1 102·2	.. 5·4
Oct. 3	Inoculated. 10 cc. Animal in poor condition, but shows no signs of ill-health. Did not react to tuberculin test. Takes food well; ruminates; fair milker.	..	..	..
„ 4	....	101·9	102·2	5·7
„ 5	....	102·2	102·4	5·8
„ 6	....	102·3	102·3	5·6
„ 7	....	102·0	102·3	5·3
„ 8	....	102·2	102·1	5·6
„ 9	....	102·4	102·2	5·1
„ 10	Beginning of febrile reaction. Animal not so bright.	104·7	106·2	4·8
„ 11	....	105·0	104·0	4·5
„ 12	Not eating well; ruminates; milk yield falling off.	104·8	104·8	4·3
„ 13	....	105·5	104·5	4·1
„ 14	....	105·0	105·6	3·9
„ 15	....	104·0	105·4	3·7
„ 16	End of febrile reaction ..	103·7	101·2	3·8
„ 17	....	102·8	102·8	3·7
„ 18	Taking food well. Milk yield improving.	102·2	102·4	3·8
„ 19	....	102·2	102·0	3·9
„ 20	....	102·4	101·9	4·0
„ 21	....	102·4	101·8	3·9
„ 22	Apparently recovered (v. blood).	102·4	101·4	4·1
„ 23	Reinoculated. 50 cc. No reaction followed.	102·2	102·0	4·6
„ 24	....	100·7	101·8	4·8
„ 25	....	100·8	101·3	5·2
„ 26	....	101·9	101·2	5·3
„ 27	....	100·7	102·5	5·2
„ 28	....	100·3	101·9	5·1
„ 29	Continues well, giving as much milk as before inoculation.	100·4	100·6	5·2
„ 30	....	101·4	102·2	5·2
„ 31	....	101·5	102·6	5·3
Nov. 1	....	102·1	102·6	5·2
„ 2	....	101·6	102·9	5·3
„ 3	....	101·7	102·8	5·3
„ 4	....	101·4	102·6	5·4
„ 8	....	101·0	101·4	5·6

„ 4	………………	102·8	102·6	6·0
„ 15	………………	102·4	102·6	6·1
Nov. 22	Has remained well	102·2	102·7	6·2
„ 25	………………	102·4	102·8	6·3
	Remained without further treatment till February, 1899; then sent to Queensland.	..	..	..
1899. Feb. 7	Placed in paddock "known to be grossly infested by virulent ticks."	..	..	..
„ 13	………………	102·0	..	7·2
„ 14	………………	103·3	..	..
„ 15	………………	102·2	..	..
„ 16	………………	102·2	..	..
„ 17	………………	102·0	..	..
„ 18	………………	102·4	..	..
„ 19	………………	102·2	..	..
„ 24	Young ticks (on animal) in enormous numbers.	104·2	..	..
„ 25	………………	102·2	..	..
„ 26	………………	102·2	..	..
„ 27	………………	103·0	..	..
„ 28	………………	105·0	..	..
Mar. 1	Very grossly infested with fully-developed ticks. Shows little outward sign of sickness. Eats and ruminates, but is failing in condition. No discolouration of urine.	105·8	..	5·1
„ 2	Failing in condition	105·0	..	..
„ 3	Sick and weak	104·6	..	5·1
„ 4	Improving. Many of the ticks have fallen off since yesterday.	104·0	..	..
„ 5	Improving	103·6	..	..
„ 6	………………	104·0	..	2·7
„ 7	Greased with kerosene and fat.	..	..	..
„ 8	Many ticks dead. Still very low, but improving.	..	..	..

„ 11	………………	101·4	101·6	4·8
„ 15	………………	101·6	101·4	4·9
„ 18	………………	101·4	101·2	4·5
„ 22	Has remained well	101·6	101·8	4·9
„ 25	………………	101·2	101·4	5·2
	Remained without further treatment till February, 1899; then sent to Queensland.	..	..	..
1899. Feb. 7	Placed in paddock "known to be grossly infested by virulent ticks."	..	..	..
„ 13	………………	102·3	..	5·1
„ 14	………………	102·2	..	..
„ 15	………………	102·4	..	..
„ 16	………………	102·0	..	..
„ 17	………………	102·8	..	..
„ 18	………………	102·2	..	..
„ 19	………………	102·0	..	..
„ 24	Young ticks (on animal) in enormous numbers. Cow looks rather hollow and miserable, but feeds and ruminates.	105·2	..	..
„ 25	………………	105·4	..	4·7
„ 26	………………	105·7	..	..
„ 27	………………	104·4	..	..
„ 28	………………	105·2	..	..
Mar. 1	Very grossly infested with fully-developed ticks. This cow even more grossly infested than others—some of the ticks on her being transparent dropsical (full of serum instead of blood). Cow, though hollow and miserable-looking, continues to feed and ruminates normally. There is no discolouration of urine. Daily failing in condition and strength.	105·6	.	4·5
„ 2	Certainly more grossly infested than the others. Failing in strength and condition.	104·2	..	..
„ 3	Sick and weak	104·0	..	4·0
„ 4	Weaker, and hardly able to move about. Still continues to pick about and to ruminate. Urine quite clear. Many of the ticks have fallen off since yesterday.	104·0	..	..
„ 5	Hardly able to stand in morning; by mid-day down and unable to rise. (Raining heavily.) Many hundred cc. of defibrinated warm blood injected into jugular vein without benefit. Killed, in dying state, in afternoon. For post-mortem examination see below.	101·4	..	1·7

„ 11	………………	101·2	102·0	5·5
„ 15	………………	101·4	101·6	5·9
„ 18	………………	101·4	101·8	5·6
„ 22	Has remained well	101·6	101·8	5·8
„ 25	………………	101·2	101·4	5·4
	Remained without further treatment till February, 1899; then sent to Queensland.	..	..	..
1899. Feb. 7	Placed in paddock "known to be grossly infested by virulent ticks."	..	..	..
„ 13	………………	102·4	..	6·3
„ 14	………………	102·0	..	..
„ 15	………………	102·2	..	..
„ 16	………………	101·2	..	..
„ 17	………………	101·2	..	..
„ 18	………………	102·0	..	..
„ 19	………………	102·4	..	..
„ 24	Young ticks (on animal) in enormous numbers.	104·3	..	..
„ 25	………………	103·0	..	7·6
„ 26	………………	101·6	..	..
„ 27	………………	101·6	..	..
„ 28	………………	102·0	..	..
Mar. 1	Very grossly infested with fully-developed ticks.	102·0	..	6·0
„ 2	………………	101·4	..	..
„ 3	………………	102·3	..	5·3
„ 4	Many of the ticks have fallen off since yesterday.	101·6	..	..
„ 5	………………	102·0	..	..
„ 6	………………	102·0	..	3·9
„ 7	Greased with kerosene and fat.	102·4	..	4·4
„ 8	Many ticks dead	101·4	.	4·0

PARTICULARS of Post-mortem Examination of N.S.W. Cow No. 2, killed in a dying state at 4 p.m., Sunday, 5th March, 1899. (Raining heavily at the time.)

Macroscopical Appearances.—Skin—covered with ticks of all sizes. Condition—low. Blood—thin and watery. Spleen—normal appearance; weight, 1¾ lb. Heart—normal appearance. Lungs—very thickly studded with hydatid cysts of all sizes; some interlobular emphysema. Stomach and intestines—normal. Liver—weight, 12 lb., studded with hydatid cysts of various sizes. Gall bladder contains thick dark treacly bile, but not granular. Kidneys—weight (without fat), 12 oz. each; pale; surrounding fat very yellow. Urinary bladder—considerable quantity of dark urine; no bile pigment; about 25 per cent. albumen.

Microscopical Appearances.—No Texas fever parasites discovered in blood from heart, kidneys, or spleen. Sarcosporidia (a non-pathogenic protozoan parasite) abundant in the heart substance. Kidneys not examined for minute structural disease.

THE report of Dr. Sidney Hunt referred to in the foregoing is addressed to the Chief Inspector of Stock, Queensland, Mr. P. R. Gordon, and is as follows :—

Dear Mr. Gordon, Tungamull, 9 March, 1899.

I think you will like to know how the experiment with the New South Wales cows has gone up to the present, so am sending you the following particulars :—

They were all aged animals, marked as follows :—

No. 1. Dehorned white cow, strawberry neck, 110 near rump, like .
No. 2. Yellow and white cow, 24 off horn, JL near rump.
No. 3. Strawberry cow, 31 off horn, RZ near rump.

They were all in low to medium condition when they arrived at Tungamull on 7th February.

They were at once placed in a well-grassed and watered paddock, which is known to be grossly infested by virulent ticks. (About forty (40) out of sixty (60) head of cattle kept in this paddock are reported to have died of Texas fever.)

For the first week after their arrival it rained heavily, so that careful observations of their temperatures, &c., could not well be made.

The following is the record of observations made on and after 13th February (seventh day of exposure) :—

Date.	Day of Exposure.	No. 1.			No. 2.			No. 3.		
		Notes.	Temp.	Corpuscles per C.M.	Notes.	Temp.	Corpuscles per C.M.	Notes.	Temp.	Corpuscles per C.M.
Feb. 13	7	....	102	7,220,000	....	102·3	5,120,000	....	102·4	6,320,000
,, 14	8	....	103·3	....	....	102·2	....	....	102	
,, 15	9	....	102·2	....	....	102·4	....	....	102·2	
,, 16	10	....	102·2	....	....	102	....	....	101·2	
,, 17	11	....	102	....	....	101·8	....	....	101·2	
,, 18	12	....	102·4	....	....	102·2	....	....	102	
,, 19	13	....	102·2	....	....	102	....	....	102·4	
,, 20	14	Temperatures not taken owing to a fatal accident to the caretaker.								
,, 21	15									
,, 22	16									
,, 23	17									
,, 24	18	Young ticks in enormous numbers.	104·2	....	Young ticks in enormous numbers. Cow looks rather hollow and miserable, but feeds and ruminates.	105·2	....	Young ticks in enormous numbers.	104·3	
,, 25	19	....	102·2	....	....	105·4	4,770,000	....	103	7,600,000
,, 26	20	....	102·2	....	....	105·7	....	....	101·6	
,, 27	21	....	103	....	....	104·4	....	....	101·6	
,, 28	22	....	105	....	....	105·2	....	....	102	
Mar. 1	23	Very grossly infested with fully developed ticks. Shows little outward sign of sickness; eats and ruminates, but is failing in condition. No discolouration of urine.	105·8	5,195,000	Very grossly infested with fully developed ticks. This cow even more grossly infested than others; some of the ticks on her being transparent, "dropsical" (full of serum instead of blood). Cow, though hollow and miserable-looking, continues to feed and ruminates normally. There is no discolouration of urine. Daily failing in condition and strength.	105·6	4,560,000	Very grossly infested with fully developed ticks.	102	6,040,000
,, 2	24	Failing in condition.	105	....	Certainly more grossly infested than the others. Failing in strength and condition.	104·2	....	....	101·4	
,, 3	25	Sick and weak.	104·6	5,140,000	Sick and weak.	104	4,000,000	....	102·3	5,360,000

RECORD OF OBSERVATIONS—*continued.*

Date.	Day of Exposure.	No. 1—*continued.*			No. 2—*continued.*			No. 3—*continued.*		
		Notes.	Temp.	Corpuscles per C.M.	Notes.	Temp.	Corpuscles per C.M.	Notes.	Temp.	Corpuscles per C.M.
Mar. 4	26	Improving; many of the ticks have fallen off since yesterday.	104	....	Weaker, and hardly able to move about. Still continues to pick about and to ruminate. Urine quite clear. Many of the ticks have fallen off since yesterday.	104	....	Many of the ticks have fallen off since yesterday.	101·6	
„ 5	27	Improving ..	103·6	....	Hardly able to stand in morning; by midday down and unable to rise. (Raining heavily.) Many hundred cc. of defribrinated warm blood injected into jugular vein without benefit. Killed in dying state in afternoon. For particulars *post mortem* examination see below.	101·4	1,750,000	....	102	
„ 6	28	....	104	2,740,000	....	..	....	....	102	3,980,000
„ 7	29	Greased with kerosene and fat.	103·6	2,980,700	....	..	....	Greased with kerosene and fat.	102·4	4,440,000
„ 8	30	Many ticks dead; still very low, but improving.	102	3,060,000	....	..	....	Many ticks dead.	101·4	4,060,000

PARTICULARS of *Post-mortem* Examination of N.S.W. Cow No. 2, killed in a dying state at 4 p.m. Sunday, 5th March, 1899. (Raining heavily at the time.)

MACROSCOPICAL APPEARANCES :—

Skin—covered with ticks of all sizes.

Condition—low.

Blood—thin and watery.

Spleen—normal appearance—weight, 1¾ lb.

Heart— „

Lungs—very thickly studded with hydatid cysts of all sizes. Some interlobular emphysema.

Stomachs and Intestines—normal.

Liver—weight 12 lb.—studded with hydatid cysts of various sizes.

Gall Bladder—contains thick, dark, treacly bile, but not granular.

Kidneys—weight (without fat), 12 oz. each; pale; surrounding fat very yellow.

Urinary Bladder—considerable quantity of dark urine; no bile pigment; about 25 per cent. albumen.

MICROSCOPICAL APPEARANCES :—

No Texas fever parasites discovered in blood from heart, kidneys, or spleen.
Sarcosporidia (a non-pathogenic protozoan parasite) abundant in the heart substance.
Kidneys not yet examined for minute structural disease.

1. The results of this experiment are obviously rather inconclusive, and it is to be regretted from the experimental standpoint that an equal number of uninoculated cattle were not sent up from New South Wales as controls.

2. Regarding the death of the one that died (No. 2), it is difficult to say definitely how far her death was due to the direct effects of the sudden and gross investment of ticks to which she was exposed; to the chronic (hydatid) disease by which she was affected; or to genuine Texas fever infection. Possibly all contributed. She succumbed finally to anæmia and exhaustion; and I have no doubt that the constant rain helped, in her weak condition, to determine the fatal issue. I never saw an animal more grossly infested than she was; and her sickness, as compared with the other two (2), seemed to

be proportionate to the number of ticks upon her—a fact suggestive that her condition was due rather to the external multiplication of ticks than to the internal multiplication of micro-parasites.

3. The *post-mortem* conditions mentioned show that this cow was not a healthy or normal one, inasmuch as her liver and lungs were badly affected with hydatid disease. Moreover, the enlargement and alteration of the spleen, which are such characteristic features of Texas fever, were altogether absent. No Texas fever parasites were discovered in her blood, although carefully searched for. There was no hæmoglobinuria during life. And her general appearance and condition were more suggestive of the condition we call "tick-poverty" than of Texas fever. She continued to feed and ruminate almost to the time of her death, the only outward indication of sickness being a rapid loss of strength and condition.

4. On the other hand, it is certain that both this cow and No. 1 had fever and considerable anæmia, as shown by the loss of blood corpuscles; also, that the condition of the bile and urine of the one that died were very suggestive of Texas fever, though not typically indicative of it. As regards the anæmia, however, it will be seen that No. 3, *which had no fever*, also suffered a considerable loss of corpuscles. A similar condition was, as you will remember, some time ago noted in the infested Boolburra cattle, which were certainly not contaminated with the Texas fever organism. Hence the anæmia cannot in itself be regarded as distinctive evidence of Texas fever infection.

5. The test of injecting blood from these cows into susceptible animals would have been of no value as evidence of present infection, because they had been inoculated; and in any case such a test could not have been carried out in this neighbourhood, where the country is infested and all the cattle immune to Texas fever and, practically, to "tick-poverty" also.

6. Considering all the circumstances connected with the death of the New South Wales cow No. 2, it cannot, I think, be regarded as an unequivocable instance in which inoculation has failed to do that which is claimed for it, viz., to protect from Texas fever. The condition of poverty and exhaustion directly resulting from a sudden and gross infestment is, of course, an altogether different matter, and one which, unfortunately, we cannot provide against by any such means.

7. I am not in possession of the precise particulars attending the inoculation of each of these animals, as regards reaction, &c., but the cow that died was certainly not a healthy or normal one, and her symptoms and *post-mortem* appearances, though in some respects very suspicious, afford no conclusive evidence that she died of Texas fever. The non-discovery of the micro-parasites in the blood, and the absence of some of the most characteristic lesions of Texas fever, must, I think, be allowed some weight on the other side.

Yours faithfully,

J. SIDNEY HUNT.

Coagulated Separated Milk for Poddies.

Mr. Paul McGruer, of Deep Creek, Casino, writes: "This year I am giving my poddies nothing but coagulated separated milk, and they are doing much better than when I gave it to them fresh from the separator." This may apparently be a good food, but separated milk in itself is scarcely what we might consider a substantial fodder. To build up a good robust frame and constitution the calves should have meal added to the milk to make up for the separated fat.

An Experiment in Cotton-growing.

A. M. HOWELL.

An experiment in cotton-culture was conducted by the writer during the season of 1898–9 for the Department of Agriculture at the Moonbi Experiment Farm, nearly 300 miles north of Sydney. The growing season was one not only of extraordinary drought but of the prevalence of high winds during the first three months of the crop year. Upland cultivated crops throughout the district were entire failures, with very few exceptions, and these exceptions were very unsatisfactory yields in low-lying river and creek bottoms or flats. All crops occupying high uplands withered away during February and March by reason of the almost, if not quite absolute, absence of moisture in the soil. Notwithstanding all this the cotton under cultivation held its own with a fortitude and persistence that was truly remarkable, and the final results show that cotton is entitled to a place in the front rank in this province as a drought-resisting crop. It vied with lucerne in remaining green and continuing to grow when all other vegetation was at a standstill, if not scorched and dead—even noxious weeds, and grass and trees in the nursery, and by the roadside, dying in their tracks for the want of water. While the yield of cotton fibre was small compared with what it would have been in a more favourable season, and while the experiment was not a shining success in itself from a business point of view, it was the very opposite of a failure in several important respects, as the facts here to be recorded will show. The student of agriculture and of the climatology of plants, as well as the observing every-day farmer who is wrestling with the questions that affect crop production, cannot fail to see from the outcome of this trial of cotton-growing in the colony that the crop is one of the surest in years of drought, whether generally profitable or otherwise. It may be further said in this preliminary *resumé* that to one who has been familiar with cotton-culture from childhood, as the writer has been, the experimental effort herein told of furnishes every reasonable guarantee that lint-cotton of excellent type and quality may be numbered among standard productions of New South Wales. Just where New South Wales cotton will stand in the markets of the world cannot be foretold with precision, and it awaits the continued culture of the crop from acclimated seed to determine its points of merit, but it is clearly shown now, from the qualities of the fibre produced this year at Moonbi, that the product will compete with at least some of the best cottons of the world.

So much by way of introduction. All that may supply useful or helpful information to those who are disposed to give cotton a trial will next be briefly related in proper order.

The Experimental Plot.

The experimental "patch" of cotton comprised two measured acres exactly. It embraced the lowest lying strip of land on the farm, and while taking in a slight valley of soil slightly darker in colour than the adjacent elevations in the same paddock, it was by no means a "bottom" or flat. The topsoil may be classed as a sandy loam, being of gray, slightly bluish granite formation underlaid and intermixed with a rather dead-coloured yellow clay. The subsoil is of the latter material, mixed and speckled with particles of granite, and is so tenacious and tough that it may be compared to putty before the glazier has softened it for use. Lumps of it dislocated by the subsoil plough were hard, heavy, and cold, and would bend almost double before breaking. Exposed to the sun and atmospheric influences these lumps crumbled and fell to pieces within a fortnight when left on the surface. The subsoiler dislodged also an occasional lump of iron ore not inferior, perhaps, to much of that article made use of in blast furnaces in the production of crude or pig iron. Mr. Guthrie's analysis of the soil of this farm showed the samples examined to contain good percentages of potash, lime, and phosphoric acid, and only a "fair" quantity of nitrogen. As to the latter element the cotton occupied, perhaps, the richest strip of ground on the farm with one corner of the plot resting upon, perhaps, the poorest. Two acres was the area decided upon with the expectation that a patch of this size would produce at least a commercial bale of 400 lbs. of lint-cotton, *i.e.*, fibre with the seed ginned out. The land was ploughed to a depth of 10 inches with an American turn-plough, followed in the same furrow by the subsoiler, the latter cutting through the heretofore undisturbed subsoil 8 inches deeper, thus breaking the soil to a depth of 18 inches. The turn-plough was drawn by two horses and the subsoiler by three. The subsoil was slightly lifted, but not brought up or mixed with the top soil. This ploughing was done the first weeks in September, but should have been done earlier. Late in October the rows were laid off 4 feet apart. This distance was adopted in the belief that, with a fairly good season, the limbs of the plants would meet between the rows. This would have occurred, but the drought decreed otherwise. With the weather that followed, the rows might have been 3 feet apart without detriment to the crop, but with 3-feet rows and seasons of good rainfall, the rows would have been too close together, and the branches of the plants so interlapped that injury to the crop would have attended the picking or harvesting. The rows were subsoiled. That is, the subsoiler was run two and three times in the first furrow, directly over which the seed was subsequently planted. In this subsoiled furrow the fertiliser (see farther on) was dropped in spoonful deposits 18 inches apart. Two furrows were then thrown into and upon this furrow with the turn-plough, throwing up quite an elevated ridge, too high for planting. These ridges were flattened down to almost a dead-level by going over the land twice with a heavy roller made of a cut from a heavy gum-log

and drawn by a pair of horses. The ridges, though well flattened, were plainly discernible after the rolling, and they were then marked along their centres by the use of a fire-fly hand garden plough, which opened only a very small shallow furrow directly above the subsoiled first furrow containing the fertiliser. In this shallow furrow the cotton-seed were dropped 18 inches apart, five to seven seed to the "hill."* A dropper preceded me, and I covered each hill or deposit of seed with ¾ to 1 inch of loose soil, stepping directly on each as soon as covered, pressing the soil to the seed with my full weight. It may be mentioned here that a covering of 1 inch of soil is as much as cotton-seed should have, or slightly more may be used in time of dry weather. Rolling well after covering would sufficiently press the soil to the seed, but to make sure of planting every hill well I adopted the above plan of stepping firmly on every one with the broadest part of one sole, mashing the seeds really lower down into the soil than they were when dropped. It took time, but that was well spent, for in from three to four days it seemed that every seed planted was up. The stand was as nearly perfect as could be desired, there being scarcely a missing hill to the row.

It is well to digress here to state that in the Cotton States, where cotton-seed is so plentiful an article that millions of bushels are used as manure (and an excellent one), the seed is drilled in a continuous row from end to end by a machine drawn by a horse or mule. A little plough in front not wider than three fingers opens a slight furrow on the ridge or bed; a revolving wheel of prongs pushes the seed continuously through a crevice in the bottom of the hopper, just in front of which runs a round-edged wooden wheel that crushes all clods in the drill furrow, and behind drags a hollowed-out board, attached to two iron arms, covering the seed with from ½ to 1 inch of soil. Thus a row of cotton is planted with every "through," and only moderately fast-going is required for one man, horse, and machine to put in 5 acres of cotton in a day.

It will be observed that the distance given to the hills of cotton (4 ft. x 1½ ft.) allots to each a space of 6 square feet. This is about the distance given by the best farmers in the States in a fertile soil with fair manuring, though the question of the best distance has always been much debated. It is a matter of experience and opinion, the principal question involved being the fertility of the soil, which governs the size to which the plants will grow. The matter should be regulated, if possible, so that the branches will barely or not quite meet midway between the rows. The poorer the land the nearer together the rows may be placed, and *vice versa*, the richer the land the wider apart.

The fertiliser used in the experiment was, as already told, dropped in the furrow in spoonful lots 18 inches apart, and afterwards the cotton-seed at like intervals; but it does not follow that the hills of cotton were placed vertically over the manure or otherwise. It made no difference,

* The term hill is meant simply to imply the place where the seed is dropped in planting any crop at distinct intervals. All crops are in hills unless sown broadcast or drilled in continuous rows, according to modern expression.

since the manure was claimed to be and doubtless was very soluble, and was soon distributed by natural means throughout the soil (mainly in the furrow, however) and was soon reached by the tap-root of the young cotton. Those who have been experimenting with cotton have, doubtless, heretofore taken notice of the fact that cotton is distinctly a tap-rooted plant, and that when the young plants are only 2 to 3 inches high the tap-root reaches downward twice the length of the plant above ground, or further. Few crops germinate more quickly than cotton, if properly planted, and none develop a root system in so short a time. Hence its ability to withstand drought once the crop is up, the root penetrating downward so rapidly, and continuing to do so throughout the growing season, or long as it can find moisture and food in a dissolved state. In all cases the roots go to the bottom of the soil, and deeper, no matter how deeply the soil has been broken. A permanent root system is established early in the season, and from the main ones up to the very surface of the ground go out great masses of tiny feeding-roots that are the life of the plant in good growing weather, their number depending upon the amount of moisture in the soil. In wet seasons these feeding-roots are very numerous, often occupying the entire soil from row to row in such fibrous masses that some farmers hesitate to give any cultivation at all, as even a light harrow will tear up and destroy great wads of them. Not many years ago the belief prevailed among, perhaps, a majority of American cotton-growers that so many roots during wet weather surcharged the plant with sap, and that this was the cause of the crop shedding or casting off a portion of its young fruit, this trouble occurring frequently simultaneously with the establishment of so enormous a system of rootlets. Acting upon this belief it became the custom with many to plough somewhat deeply alongside the cotton, to cut off these masses of roots, and thus prevent or stop the evil. It was argued, on the other hand, that this augmented rather than curtailed the shedding. There are those who still adhere to the old notion, but I believe the majority of opinion now is that the roots in any and every case should be disturbed as little as possible. Shallow cultivation is kept up after rainy seasons, but very shallow cultivation only.

The Time of Planting.

The cotton was planted, as above related, on the 29th day of October. The reasons which led to the adoption of that date were (1) to avoid a frost after the cotton was up, which greatly sickens the plants, though not killing them outright unless very severe, and (2) to conform to the now prevalent belief obtaining in the Southern States that later planting, avoiding cold nights and starting the crop off in warm weather only, are considerations conducive to the early and continued health of the plants. With many of the best farmers, too, the belief prevails that it is best to start the crop later than was formerly the custom, in order to avoid too heavy fruiting or the setting of more than one crop of fruit.

The Shedding of Fruit.

It is the habit of the plant in the States, under encouraging weather conditions, to set two separate crops of fruit, one in July and the other in August (here in January and February). It rarely, but sometimes, does occur that most of both these crops, so-called, are carried to maturity, in which cases the yield is very heavy. But in the vast majority of instances, if warm moist weather encourages the setting of an August crop much, and sometimes nearly all, the fruit put forth in July lets go its attachment to the plant, and falls to the ground in the form of buds (or forms, or squares, as they are called) and young bolls. The question of cause in this matter has long been debated, the ablest, and even scientific, men differing as to why the crop sometimes sheds its fruit after seasons of rain. Some opine that when late summer rains occur the plants taking on new growth naturally, of its own volition, as it were, rids itself of its early burden in order to indulge in the pleasure of bearing again. It is noticeable that shedding almost always occurs after or during these late summer rainy seasons. Opposed to the above view, is that of men renowned in agricultural science, that the shedding is caused by the collection of water, during such spells of weather, in the little cup that contains the blossom and young boll. At this period the young fruit is erect, point upward, and the cup alluded to does catch and hold water, which, it is claimed, starts a species of fermentation about the stem of the embryo, causing it to drop. The writer cannot decide which is the correct view. Be the cause what it may, the shedding sometimes occurs in dry weather, when there has been no recent rains, and it is seldom, as already said, that a crop of cotton brings to maturity all of both its first and second settings of fruit-forms. That is the case in the cotton States. Whether this weakness of the plant will eventually show itself in Australia, or in New South Wales, it remains for the future to unfold. It is quite likely that the habits of the plant are the same in all countries. During the past season, after a season of hot dry weather, continuing for a month, there was quite a spurt of rain on the 18th of January—a shower only that was soon almost forgotten in the parching weather that followed. Just after this shower there was a slight shedding of the very young forms of the experimental cotton—not serious, but enough to notice upon an inspection of the ground between the rows. Whether the evil of shedding will follow the crop in this country, whether the remedy is in late planting to avoid excessive fruiting, or whether good is to come out of the bad, and that other greater evil of dry summers may be depended on to limit the efforts of the cotton plant to the load it can safely carry and land, are questions for future observation and experiment.

The Manuring of Cotton.

The fertiliser used under the experiment cotton was the Colonial Sugar Company's No. 5. This brand was selected because containing, according to Mr. Guthrie's report, high percentages of the elements of

plant-food required by the cotton crop. Though not proportioned according to the standard in the States, the different substances in it were in excess of that standard, requiring the use of less than the usual quantity per acre to place the same quantities of plant-foods in the soil. In the States the average composition of commercial fertilisers sold for cotton is about as follows:—

Nitrogen	2 %
Potash	2 %
Phosphoric acid	9 %

The No. 5 manure used here purports to contain—

Nitrogen	4 %
Potash	7 %
Phosphoric acid	26 %

The American manure is usually applied at the rate of about 700 lb. per acre, which gives, per acre—

Nitrogen	14 lb.
Potash	14 lb.
Phosphoric acid	63 lb.

while the Sugar Company's No. 5 gives at the rate applied (3 cwt. 336 lb.)—

Nitrogen	13·4 lb.
Potash	23 lb.
Phosphoric acid	87 lb.

The selection of the richest strip of land in the paddock was accounted as being sufficient to make up for the shortage in nitrogen, and an excess of phosphoric acid was considered as not a waste, as this element tends to make plants, especially cotton, fruitful, while potash in abundance is a most strengthening and sustaining food for almost all crops. The splendid growth made by the cotton, during early summer, convinced me that the selection was a good one, and the long time the crop held out against the most trying weather plants ever have to endure, showed that the manure was lasting as well as quick in its effects. It was only after the middle of February, when the parching drought was at its worst, that the cotton discontinued growing and cast much of its half-grown fruits. Previous to this time many young bolls died and dried brown, hanging on the plants.

An examination of the soil and subsoil, at this time, failed to discover any moisture perceptible to the eye or the feel of the fingers; yet the plants remained alive, supported apparently only by the little moisture the tap-root could draw from the under subsoil.

It may be mentioned here that while the figures above given represent the proportions of fertilising ingredients contained in ordinary cotton manures in America; the best farmers often more than double each of them in the production of large yields. From the investigations of the

different State experimental stations, the following formula may be regarded as a good well-balanced fertiliser for cotton :—

Nitrogen	3%
Potash	3%
Phosphoric acid	9%

A good commercial fertiliser of this formula is generally applied by the best farmers at about the rate of 600 to 1,000 lb. per acre.

Experience, common observation, and scientific experiments all prove conclusively that cotton, while responding with alacrity always to the liberal use of soluble or digestible commercial fertilisers or other well-decomposed manures, is the least exhaustive of nearly all farm crops. If the rubbish of the plants, the leaves, stalks, &c., be beaten down and ploughed under, and the seed or their equivalents in commercial manures be used under the crop at the time of planting, there is exceedingly little loss to the fertility of the soil by the lint, which is mostly composed of carbon, an element which plants derive from the atmosphere. The oil may be extracted from the seed also without loss, as it furnishes no plant-food to the soil. Cotton-seed, as is well known is a most excellent manure in itself, and is universally used as such in the States for any farm crops, either in the shape of whole seed, crushed seed, or cotton-seed meal, the latter being the cake after the oil is expressed, ground into a fine yellow meal. It is not out of place to mention in this connection, inasmuch as I am carrying the whole subject along throughout this report, that the by-products of cotton, consisting chiefly of the oil, meal, and hulls of the seed, are reckoned as being worth, and as fetching in the markets, one-sixth of the total value of the country's crop. The seed, whole or decorticated, minus the oil or hulls, is one of the richest of animal foods. And the seed-hulls alone, surprising as it may appear to many, constitute an excellent food for cattle and sheep. It is usual for the farmer to take his cotton-seed from the ginnery to the oil-mill. He does not wait to have his own seed manipulated, but makes an instant swap of his waggon-load of seed for meal (and hulls if he desires to feed his meal), and he gets an excess of meal equal to the market value of the oil in his seed. The usual method of feeding the residue he gets is to give his stock (cattle and sheep) a fairly good feed of hull sprinkled to the point of yellowness with the meal. The meal is so very rich in protein that it can only be fed sparingly with safety to cattle, and not at all to pigs, except in minute quantity, mixed with other food-stuffs. It is not usually fed to horses, and access to a sack of cotton-seed meal by neglect means a terrible colic and spasms, and probable death of a horse.

The Variety Cultivated.

The variety of cotton cultivated in the experiment under consideration was the Peterkin, well known throughout the cotton States as a sort producing a short staple of fine fibre, and above the general average of lint from a given quantity of unginned cotton. It belongs

to the species known botanically as herbaceous cotton, being of low growth (2 to 4 feet). It is evidently a hybrid, containing, as it does, many small black, smooth, downless seeds. Like nearly every other variety of short-staple cotton, it is beyond the power of botanists to say whence it origin, since its parents were probably also hybrids.

Notes on Varieties.

It is remarkable that the origin of most of the best cottons in cultivation is obscure. It is believed that the American long staples sprung from the tree cotton of India. The plant hybridises so readily without man's aid, and there have been so many interchanges of seed by the different cotton-growing countries of the world, that botanists have lost the thread of the cotton story. No two of them can agree upon anything like a complete classification of the different sorts; hence all is chaos in this matter, and growers everywhere must take and utilise what they find, with nothing but unscientific human experience in growing the fibre to guide them. India produced, centuries ago, cotton-cloth that was so fine and soft that early writers described it as "webs of woven wind," and when it was spread out on the dewy grass to bleach it is said to have become invisible. Whilst it is believed that the finest American was of Indian origin, the East Indians themselves have been cultivating chiefly American varieties for the past fifty years, and no cotton in the world can match in length and fineness of fibre and in peculiar creamy silkiness the Sea Island cottons of the States of South Carolina and Georgia. Remove the seed of this cotton farther north or farther south and the product at once deteriorates. It is grown in a constantly warm and constantly humid as well as very equable climate. It cannot be produced 20 miles inland from the coast islands which it now makes famous. Perhaps there are other islands in the sea that will yet compete in this exceptional article, but they have yet to be found out. Nevertheless, the most humid coast regions of Australia, and the warm, sunny islands of the Pacific comprised in Australasia, ought to test their soils and climates with the known choicest of varieties.

Adaptation of Soils and Climates.

While uplands or short-staple varieties must remain the chief dependence for the world's supply, there is always room for improvement in these. There are many so-called long-staple varieties that produce a very superior fibre in length and fineness in rich river bottom lands and coast regions of higher relative humidity than the dry highlands of the interior of the country. Low-lying, swampy lands, when reclaimed, produce a superior fibre than the latter regions, even from the same variety of seed. Intensive cultivation, or what is sometimes termed "high farming," also increases the length and silkiness of the fibre, and, lastly, seed from the earliest-maturing bolls will generally produce a longer and superior lint than those maturing later.

Later Classification.

It used to be that only Sea Island cotton was classed as "long staple," and this type surely produces the longest as well as the smallest or finest cotton fibres, but within the past twenty-five years, so great have been the improvements in the staple or lint of herbaceous and shrub cottons, resulting from a more extended knowledge of soils, improvements in seed-saving, and cultured methods and manuring, that some of these latter come in for designation as long staples. The classes of "short," "medium," and "long" cottons have therefore sprung up, and are arranged in this order. Cotton fibre of less than 25 millimetres in length is classed as short staple; fibre from 25 to 30 millimetres belongs to the class of medium staple, and those which exceed 30 millimetres in length are termed long staple. The variety planted in the experiment at Moonbi, the Peterkin, is accredited with a fibre measuring 22 to 25 millimetres, and is therefore classed as short staple.

Quality and Yield of the Classes.

As the finest goods are said to be always done up in small packages, the cotton-plant adheres to the old adage, and refuses to deliver very fine cotton in any other than small bolls, and fewer of them than it renders up in the shortest staples. The length of the fibres of the best Sea Island varies from $1\frac{1}{2}$ to $2\frac{3}{4}$ inches in length, and is put down as 640 millionths of an inch in diameter. Long cottons grown in the valley of the Mississippi, in the protected deltas, average slightly over an inch in length and 775 millionths of an inch in diameter. Ordinary upland cottons range from $\frac{3}{4}$ to 1·06 inch in length, and average 763 millionths inch in size. The maximum length of Egyptian cotton is 1·52 inch, and the average is 1·41 inch. The finest grown in India is from Sea Island seed, the longest 1·65 inch, and the average $1\frac{1}{2}$ inch. As a rule the longer the fibre the smaller the diameter.

Methods of Cultivation.

The preparation of the soil for the experiment plot has already been described, and that description may be regarded as a good general guide for the preliminary work of cotton-planting. No good farmer need be told of the value of several harrowings and rollings where needed. After the cotton was planted, the horse cultivation was done entirely with the Planet Jr. cultivator, which was run twice to the middle four different times, varying from a week to eighteen days apart. The rule is to cultivate as soon as permissible after each and every rain, and as often as once in every ten days if practicable, even when no rain has fallen since the previous cultivation. The cotton was hoed twice, which was all that was necessary to clear the rows of grass and weeds.

Brief History.

As above noted, the 2 acres of cotton, in rows 4 feet and hills 1½ foot apart, were planted October 29th, and was up to a practically perfect stand within (say) five days—nearly all in four days. When the crop was all well up, and the bunches of young plants stood clear and erect, the cultivator and hoes went through for the first time, and the plants were thinned out to two to the hill. Ten days later the cultivator was again run around each row, and the cotton, which was now showing well its second and third set of leaves, was thinned to one plant to the hill. Shortly after this the "ground grub" or "garden grub," as the travelling cut-worm is called, began to play havoc with potatoes and tobacco planted in soil adjoining the cotton. From tobacco to potatoes, and thence into the cotton, a small army of these pests crossed over. Their depredations were committed at night, of course, at which time they climbed the plants and devoured the leaves. As soon as they were discovered a vigorous attack was made upon them with hand and hoe, and they were destroyed in considerable numbers. Poisoned baits were prepared for them, but before placing these it was found that the intruders had departed. Their subsequent depredations were confined to the potatoes and tobacco. In all about one-twelfth of an acre of plants were defoliated, or nearly so, the worms cutting a swath or road through the cotton about 40 feet wide, and seeming to continue their journey southward, never returning to the cotton. This was the only attack of insects of any kind during its growth and the cotton flourished unmolested until all the moisture seemed to have left the soil about the middle of February.

Periods of Development.

The first buds, usually termed forms, appeared about 18th December, which was fifty days after planting, which is about the usual length of this period. The first open blossom was seen 7th January, or seventy days after planting, which was a week earlier than the usual time. The first open boll of cotton was seen 21st February, or 115 days after planting, which is five days less time than what is recorded as the minimum period from planting to the first open boll, in South Carolina. It is well established from continued experience, as well as from direct experimentation, that soluble commercial fertilisers, and especially those containing considerable ammonia, hasten the maturity of cotton. The writer knows from personal experience that short-staple cotton has been very successfully and profitably grown high up in the mountain regions of the South Atlantic States for the past twenty years; the development of the industry in these colder and more humid regions, were the seasons are considerably shorter than on the coast, following quickly upon the discovery or general dissemination of the fact in agriculture, that soluble phosphates, accompanied by ammonia, stimulate plants into quicker and earlier growth, and thus shorten their periods of vegetation and maturity—the ripening of their fruits. Another

most interesting and economically-important fact in the same relation is that in these higher regions, which were formerly considered outside the limits of the cotton belt, produce really finer short-staple cotton than do the warmer regions, and longer seasons further southward, and also compete successfully with the latter in the matter of productiveness, or quantity per acre. That cotton, a plant of tropical origin, should thus adapt itself to climatic conditions quite out of its sphere, is accounted for by Ravenel, a distinguished botanist, upon what is termed, "that general law of cultivated plants, that their culture is most profitable at the northern limit at which they can be grown, inasmuch as their yield at that point is greater, the cultivation cheaper, the period of growth being shorter, and their products of better quality." The same author alludes to latitude alone as being the only reason that can be given why South Carolina long-staple cottons are superior to those of Georgia and Florida, which States are farther south, or farther removed toward the tropics. In upland cottons, also, the testimony of expert cotton samplers is cited to show that in the higher mountain regions of the same State the fibre is finer, stronger, and more even or uniform in length than that raised south of them.

The Proper Australian View.

If the foregoing assertions and doctrine as to that not generally understood law of cultivated plants be true (and the writer knows enough of them from personal experience and observation to believe them to be literally so), what application have they to New South Wales and the balance of Australia? We will first turn the world around, end for end, by striking out the word "Northern" in the above quotation and inserting the word "Southern" in its stead, and if the law mentioned is a general law, then every word of it applies to this country as it does to South Carolina, from which the colder regions and shorter seasons lie to the northward rather than to the southward as from New South Wales. Draw a straight line around the earth through Sydney and another parallel through Charleston, South Carolina, and you have two lines about equidistant from the equator, the one city or State being the antipodes of the other. This similarity of positions in the zones ought to signify a similarity of agricultural capabilities if not of natural products. But the reliable facts and data quoted signify further what I know is new information to many, if not most of the people of this colony, that the area adaptable to the culture of excellent cotton extends farther and wider into the various districts of the province than is generally supposed. The writer personally knows that the mountain region of the American South Atlantic States above-mentioned, where the best of short-staple cotton is profitably grown, has climates that are more unfavourable to cotton-growing than the district of Tamworth; and that the climate of Charleston, S.C., is very similar in temperature, rainfall, general humidity, and soils to the corresponding conditions that prevail in and about Sydney.

The Experiment Proves

To the satisfaction of the writer that, with fairly good seasons of rainfall during the growing period of the plant, which embraces an ample time of over six months in the year, that cotton of the highest quality of the short-staple class can be made one of the surest or most certain crops that can be grown in the Tamworth district. And from a long-studied general and particular acquaintance with the subject, he is convinced also that long-staple cotton of high quality and commercial value can be abundantly produced in the vicinity of Sydney and various other parts of the province of like climatic conditions and environments.

The experiment at Moonbi the past season was not, to the ordinary impatient business view, a financial success, but the assurance is here given in all sincerity and candour that it proved all that the writer desired to demonstrate: that the country is well adapted to the production of high-class cotton of several types. The year was one of unusual severity, and this accounts for the small yield of cotton, the only objection that can be pointed to in the whole matter.

The Results in Brief.

The yield of seed-cotton, which has not yet been ginned, was 466 lb., which a hand-separating examination shows will yield, when ginned, nearly or quite 200 lb. of lint and 250 lb. of valuable seed. The length of the fibre will average an inch or more, and its fineness and other spinning qualities are, to the experienced eye, fully up to the standard of American short staples.

In Conclusion.

It may be interesting to record that while the average yield of lint-cotton in the States is slightly less than 200 lb. per acre, this includes much of the most slovenly farming by negroes and uneducated whites, and the yield on the best conducted farms is from 500 to 800 and even 1,000 lb. per acre. Good uplands yield from 33 to 40 per cent. of their weight in lint, the balance being valuable seed.

Planting, Fertilising, and Cultivating Sugar-cane for best results in Sugar.

At the last meeting of the Lousiana (U.S.A.) Sugar Planters' Association, in April last, reference was made to the disastrous effects of the cold weather experienced last season, and the absolute necessity for adopting means to counteract in some degree such calamities, and at the same time effect economy in production of cane of the highest milling value.

A number of interesting papers were read and reproduced in the *Lousiana Planter,* from which the following papers by Messrs. R. G. Comeaux and W. L. Goldsmith are reprinted.

Although much of what the writers say applies strictly to American conditions, it is thought some of the information given with respect to sugar production will be of interest, and possibly of value, to cane-growers in New South Wales.

Mr. Comeaux's paper is as follows :—

"The subject adopted for discussion to-night is one of vital importance; it is one upon which will depend largely the destiny of the sugar industry of Louisiana.

"The time is not far distant when we will be brought in competition with the world in the production of sugar—when we will compete with those countries who, favoured either by Nature or by science well applied, have been able to make their cane or beets produce the maximum of sugar per ton.

"When we consider the disastrous results of the season just elapsed, and all on account of cane which was deficient in sugar qualities, then it strikes us forcibly that something must be done to improve our cane.

"The question is now asked—What is the best method of planting, fertilising, and cultivating cane so as to give best results in sugar? I dare say if the question was put to 100 people who are growing cane in Louisiana, that hardly two would give exactly the same method. If such should be the case, and I believe it would, then why should there be so many different methods of growing the same cane on the same lands?

"The old method, and one still largely in vogue, that of deep ploughing in cane late in July, or until the mules are entirely hid by the cane-tops, will have to cease.

"The season in Louisiana is too short for cane to mature, and as its age dates from the day it is laid by to the day it is cut, then it is evident that cane laid by in the middle of July, and cut in October for the mill, would be very immature, unless the fall months were either very dry or the land was so poor as to cease nourishing the cane along

in September. For the reason last given, cane in old worn-out lands produces plenty of sugar, but as that kind of cane always results in low tonnage, does it pay? Is there no means by which we can combine the two—heavy tonnage and good sugar yield? I believe that if ever the chemist is to help the sugar-planter, he will start right here; he will analyse our soil, and tell us in what properties it is deficient.

"It is useless to believe that we can dispense with the use of commercial fertilisers in the growing of sugar-cane; still many contend that fertilisers produce green cane.

"The first requisite to grow cane successfully is to have good drainage; the second, in my opinion, is fertilisers judiciously applied. In all styles of business we have systems; have methods expressed and well defined on paper, which are guides to run the business, and we have recourse to them from time to time, as the occasion requires, until we have learned to make a success of our business; but in my long experience of raising sugar-cane, I have not yet seen a method or treatise on cane-growing, a method by the practice of which a beginner could start in the business, and, by giving proper care and attention, be guided to success. It is the general belief that no definite method can be formulated by which cane can be cultivated uniformly through the different seasons. It is very true our seasons are unfavourable sometimes, but if we notice closely this condition does not extend throughout the whole year, each year having some good as well as some bad features.

"As I have already stated, every man growing cane has his own method, and while many may claim their method to be the best, still I think it will be necessary to combine the best points from the different methods, and by that means conclude upon a general method. In order to do so it will be necessary to get individual ideas. Individual ideas are not easily obtained, especially when wanted on subjects on which one feels not over-confident in himself. While I am no exception to the rule, I am willing to come in for my share of criticisms, and will give my method of growing cane.

"Sugar-cane is a hardy plant; it stands the vicissitudes of our climate better, and is safer than any of the staple crops which we grow; still, for all its advantages, we make failures of it sometimes.

"In order to grow a good crop of cane it is necessary to first plough the land deep in the fall. The effect of the freezes helps a great deal to pulverise the soil, so as to make it impart its goodness to the canes as soon as they begin to sprout.

"Were it not for the inconvenience of loading and hauling cane in waggons with tread too wide to fit the rows, cane could be planted in rows 5½ or 6 feet apart; but where lands are sandy and strong, cane grows of such length that when cut they overlap narrow rows, and much of the ends are crushed by the waggon wheels as they drive through the cuts. I have, therefore, been compelled on that account to adopt as the distance between rows 6 feet in black, and 6½ feet in sandy lands. It has always been the custom to leave cane on the bar furrow until it was up to a stand, and even longer, that the sun might

heat the roots. That, I believe, is an error. Cane should, as early in the spring as is considered safe from the cold, be barred off and scraped very close, but it should remain in that bare condition only a few days, when a light furrow should be brought up on each side to retain moisture; from thence cultivators with narrow shovels can be worked frequently to great advantage.

"It is just at this stage that commercial fertilisers cut a most important figure; not being versed in chemistry, I will only speak from experience.

"Eight years ago I began to use fertilisers. The first year I used 8 tons; since that time I have increased the amount gradually every year, until last season I used 104 tons. I have not yet reached the limit, and still consider it safe to use more.

"My first idea of using fertilisers on sugar-cane was gotten from Mr. Maginnis, of the Planters' Fertiliser Co. Although Mr. Maginnis had not been long in the sugar business, he contended that even in well-prepared pea-vine land, cane could be made to ripen sooner if a certain amount of fertiliser was used at planting time. He claimed that as soon as the mother canes came out of the ground the extra nourishment afforded would bring the suckers out at once, and that the growth would be so rapid as to permit laying by three or four weeks sooner than usual.

"Starting with that idea as a basis, I find from actual practice that I can use fertilisers with safety.

"As far as I can see, our lands for sugar are deficient in two ingredients—ammonia and phosphates. To get the required amount of each is what we have to determine. In order to avoid confusion, I have confined myself to two grades of fertilisers, namely, standard high grade and McCall's formula, both made by the Standard Guano and Chemical Manufacturing Company. High grade is used in plant cane, at the rate of 300 lb. per acre in pea-vine land, and McCall's formula is used in stubble, in amounts to suit requirements of land, from 500 to 800 lb. per acre.

"The method of cultivation depends a great deal upon the strength of the land. Where lands are poor deep ploughing has to be resorted to in order to keep the cane growing, but if fertiliser enough is used in the drill cultivation can be lightened so as to simply bring the dirt up from the middles, covering the roots gradually without cutting them.

"This work can be done to great advantage with cultivators, of which we have a great number, and by the frequent use of which grass is destroyed in the bud, thus reducing hoe work. There are several cultivators which are well suited for cane work; they are built strong, and with shovel attachments can be run deep on the sides of cane until it is 2 feet high; from then on the disc cultivator should be used, leaving two or three furrows only in middles for the plough.

"Cane should be hilled up finally as much as possible. In order to cheapen this work, I have a fluke attachment for Avery's Advance plough, which, if run after middles are ploughed out last time, crushes

the furrows, and raises fine dirt up to the cane. When cane is laid by in this manner it offers much resistance to the wind, and is always straighter when cut for the mill.

"The laying by of cane should not be later than 4th July (in U.S.A.)."

Mr. Goldsmith, as a manufacturer of fertilisers, took for his subject, "The Best Method of Fertilising Cane, so as to give Best Results in Sugar," and said :—

"I come, not to teach, but to be taught; not to give, but to receive information. Content will I be if I can add my humble mite of information toward the future prosperity and glory of your great industry.

"And again: As manager of the New Orleans Acid and Fertiliser Company, I beg to say that we have invested, in a plant in Gretna, La., just across the river, 150,000 dollars, exclusive of real estate, and have fitted up this plant with every possible scientific and practical arrangement known to the business. We have a competent and experienced corps of employees, embracing chemists.

"This is said to show the mutuality of our interests, and the faith we have in the future of sugar.

"I desire to remark in the outset that, unless there is proper preparation for planting, and cultivation thereafter, we cannot get even passable results from the very best fertiliser, but each depends upon the other, and, where we have thorough preparation, the right kind of fertiliser, and proper cultivation, success will be sure to follow. It may be defeated once in a while on account of the seasons, but, in a given number of years, the general average will be great success.

"We believe that the sore trials through which this industry has gone during the past year will prove a blessing in disguise, for we believe that mistakes have been made in the use of the proper fertiliser best adapted to the sugar-cane.

"While the sugar interests have exhausted every means possible to invent and employ machinery to extract the last drop of juice from the cane, which is commendable, we fear that sufficient interest has not been given to enriching this juice in saccharine matter. The growers of beet-sugar, both in Germany and in this country, have perhaps paid more attention to the fertilisation of their crops than we.

"All plant and animal life require three distinct elements of nourishment—nitrogen, phosphoric acid, and potash; and we contend that it is just as important to know the chemistry of plant-food as it is of animal and human food. No family can prosper in health, that richest of blessings, unless they understand the chemistry of the kitchen. People require nourishing foods, and that of different kinds—vegetable, bread, and meat. Exclusive use of any one is injudicious. Neither will plants thrive best on one kind of food alone. They must have nitrogen, phosphoric acid, and potash, and, as a general rule, all three of these chief fertiliser ingredients are absolutely necessary.

"Time will not permit me even to mention the various sources of nitrogen composing the three great classes of mineral, vegetable, and animal nitrogen. Suffice it to say, that this information is of utmost

importance, as the range is from worthless to good; from cotton-seed meal, our own native product, which is perhaps the best, to scrap leather, which is almost worthless.

"The same can be said of potash salts. Phosphoric acid, however, is the same, derived from whatever source. The essential thing is to get available phosphoric acid, that which is changed from tricalcic (or natural) to monocalcic and dicalcic. By available we mean such as will afford plant-food during the life of the growing plant.

"Judging from the analysis and observation of the soil of the sugar-cane district of Louisiana, it is comparatively well supplied with potash and nitrogen, but not with phosphoric acid.

"Nitrogen, as you know, stimulates growth, potash strengthens and straightens the stalk, while phosphoric acid enriches, with saccharine matter, the sap, and hastens maturity from two to four weeks.

"A good fertiliser for the average lands of Louisiana should contain about 3 per cent. of ammonia, 7 per cent. to 8 per cent. of phosphoric acid, and 1 per cent. of potash, and from 400 to 800 pounds used per acre.

"The use of fertiliser containing from 8 per cent. to 10 per cent. of nitrogen we deem neither economical or judicious. Ammonia, which is one of the most volatile of gases, will generally expend itself in a comparatively short time, and, even when derived from a vegetable source, such as cotton-seed meal (which is slowest in decomposition), a very large percentage will leach out and pass away, without nourishing the plant; and that left behind will unduly stimulate it to a luxuriant overgrowth.

"We all know how a crop highly stimulated with ammonia appears—large luxuriant stalks which challenge our admiration, and which are a delight to look upon, and to show to our neighbours, but too often it is like unto the 'Whited Sepulchre'—beautiful to look upon, but within, full of insipid sap. There is something more to be desired than luxuriant growth, frail and tender, to be blown about and tangled by every wind. It would be better to have a smaller stalk, nourished with ammonia derived from nitrate of soda and cotton-seed meal combined, the first to give quick and active support to the young and needy plant during the cold spring weather, and the latter, by its slower decomposition, to nourish and feed it during its first two or three months, with sufficient potash to strengthen and straighten its stalk, and plenty of phosphoric acid to enrich and nourish, with saccharine matter, its juice. Man cannot create life, but he can nourish it into vigorous growth and abundant fruitage, or can starve and kill it.

"I mentioned above what I deem the best fertiliser for our average soil, but every rule has its exceptions. I am aware that every planter is the best judge of his own soil, and, therefore, should know best what fertiliser to use. I do say, however, that no fertiliser should be used that does not contain a large percentage of phosphoric acid. If any one of the above-named valuable ingredients is to be left out, do not let it be the phosphoric acid; and if any one of the three above-named ingredients is to be used alone, by all means let it be the phosphoric

acid. A great deal of our virgin soil needs nothing but phosphoric acid to enrich the juice of the cane, and to force it to an earlier maturity, while other soil may need potash and nitrogen; but, in a great majority of cases, a moderate use of potash and nitrogen is sufficient, inasmuch as the soil, if properly prepared and cultivated, will furnish an almost sufficient supply of these two valuable ingredients, but in no case can a soil be found in the sugar district of Louisiana that would not be greatly benefited by the liberal use of phosphoric acid.

"The kind of phosphoric acid which is best is that which has the largest percentage of it immediately available, such as water-soluble and citrate-soluble phosphoric acid. The insoluble phosphoric acid, such as raw bone, or bone phosphates which have not been acidulated, is too slow in decomposition to answer the purpose. The raw bone in our markets takes one, two, and three years to naturally decompose in the soil and furnish phosphoric acid as plant-food for the growing cane.

"Science has acidulated bone phosphate, and has made 90 per cent. immediately available as plant-food. I cannot see the economy of a planter burying his money in the ground in the shape of insoluble phosphoric acid, be it derived from raw bone or bone phosphates, there to lay unremunerative for one, two, and three years, when, for the same or less money, he can buy a fertiliser containing a large per cent. of water-soluble and citrate-soluble phosphoric acid, which are immediately available as plant-food, and a small percentage of insoluble phosphoric acid, which will be available the second year, on account of its finely-ground condition.

"The present method of applying fertiliser, as it is now practised, is perhaps as good as any. The plant canes, whether fall or spring, should be placed in furrows that have been previously drilled or strewn with the fertiliser, and thoroughly intermixed with the soil by running a plough after the drill, or, if stubble, it should be fertilised after the off-barring, and just before the soil is turned back to the cane.

"We believe that one application of a well-balanced fertiliser, at the proper time, would be best; but, in seasons like the present, where so much valuable time has been lost by wet and cold weather, the crop, whether plant cane or stubble, should be liberally fertilised at as early a day as possible, by strewing the fertiliser in a furrow from 12 to 14 inches from the cane. Especially it is important to make up lost time by thoroughly fertilising the present crop.

"We all know that the sweetest cane is that which is most matured when the fall time comes; therefore, it behoves us to push forward, by the liberal use of phosphoric acid, the crop to as early maturity as possible, so that its sap will be as full of sucrose as possible before the harvest time arrives.

"Especially is this important, in view of getting the best seed cane. One should fertilise his entire crop, if possible, but certainly the cane intended for seed should be fertilised judiciously and liberally, thus guaranteeing straight, strong, and healthy cane.

"I say judiciously, because if fertilised with an unbalanced ration where nitrogen predominates, our cane will be crooked, green, and

sappy, with protruding eyes and heavy tonnage; but, as above stated, whether the cane is for seed or for the mill, it is of utmost importance that it should receive the proper nourishment in the way of a fertiliser, well balanced in its essential parts, which will produce a straight, strong, and not over-grown cane, but one rich in sucrose.

"Results are what we want, rather than appearances, and we believe that the time is coming when our planters will lean more than ever upon their chemists and the suggestions of science, and will pay closer attention, not only to preparing and cultivating, but to the judicious and proper fertilisation of their cane.

"But, as above stated, in its last analysis, it is narrowed down to this: The planter should, and must, know better than anyone else the character of his soil, and the kind, quality, and quantity of fertiliser necessary and best adapted to his soils and crops.

"We have faith in the superior methods and intelligence of our planters. We, therefore, do not indulge in the fearful forebodings heard concerning the future of this great industry. In our humble opinion, Louisiana will still be the 'Queen of Sugar,' although the beet-sugar of the west and the tropical isles, including the 'Queen of the Antilles,' have sprung forward, with unshackled limbs, to vex us with their competition.

"This country, with a sugar consumption of over 2,000,000 tons, and only producing about 25 per cent. of this amount, and requiring one-half the price of our vast cotton crop to pay for the importation of the 75 per cent., presents strong reasons for encouragement.

"We have shown our faith, as mentioned in the first part of this paper, by making large investments in your midst, to furnish proper fertiliser material. We can furnish any grade of fertiliser, or any kind of material that a planter may want, in any kind of combination he may desire. He must judge the wants of his soil, and we will supply it.

"We are deeply interested in this question; interested second only to the planter. If he lives, we will live. If he perishes, we will perish. But our faith, as above stated, is as bright as the Morning Star. We do not think of failure for a moment. The past year, with all its trials and tribulations, has not in the least diminished our faith, and we confidently look forward to a brighter and more glorious future for sugar than ever before known."

A Leaf-mining Caterpillar.

By WALTER W. FROGGATT,
Government Entomologist.

Early in May my attention was called by the Curator of the Botanic Gardens to a very destructive grub that was infesting the foliage of a beautiful South American creeper (*Mina lobata*), which covers the side of one of the large green-houses, and at this season was just coming into full bloom. Every leaf was more or less discoloured and withered; and though I found a slender green looper caterpillar (the larva of the common Noctuid Moth, *Plusia verticellata*) feeding upon them, closer examination showed that it was a very tiny little dark-reddish coloured grub that was doing most of the damage. These larvæ were crawling about in numbers on the under-surface of the leaf, and when touched dropped on a fine thread to the ground; but their method of feeding was peculiar, as they gnawed through the epidermis, and burrowed into the soft tissue between the outer and upper skin, soon causing the leaf to dry and fall to the ground.

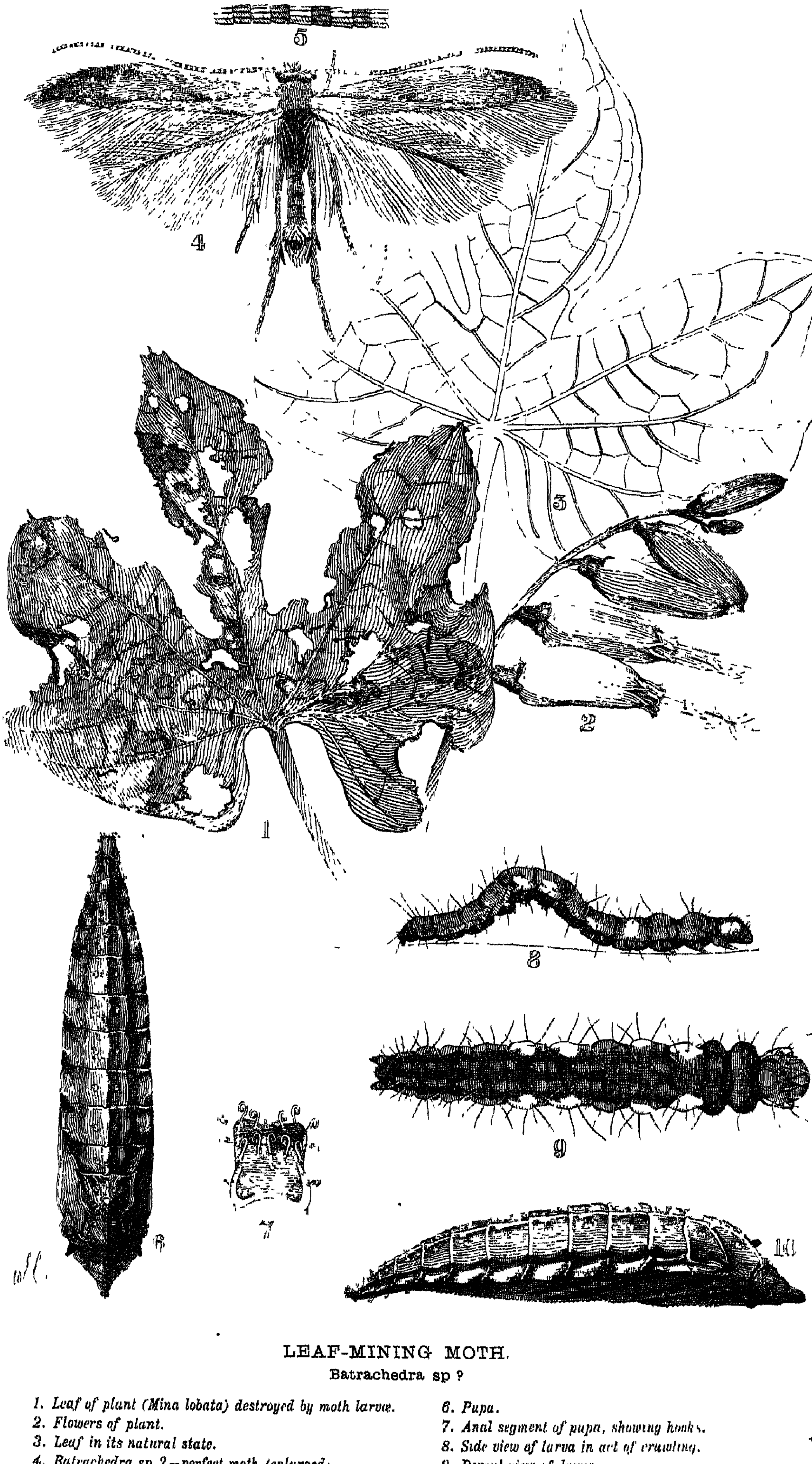
At the end of the month it was hard to find a single leaf upon the creeper. The foliage had been completely stripped off, with only the flowers at the tips of the twigs showing it was alive.

The caterpillar has a peculiar gait, crawling along half looped up, and not in the ordinary manner that the true looper caterpillars arch their backs—in a regular arch.

Larva.—Quarter of an inch in length, slender in proportion to its length, and lightly covered with scattered brown hairs. The head is large, rounded behind, dull yellow, mottled with reddish-brown; the first thoracic segment is much lighter than the two following ones, which, with the abdominal segments, are of a bright reddish-brown colour; the segmental divisions well defined and rounded on the sides; a light-coloured dorsal stripe running from behind the head to the tip of the abdomen; the first and second abdominal segments marked on either side with a small irregular-shaped creamy-white blotch; the fourth and fifth ornamented with two smaller white spots on either side. The legs stout, brown, tipped with a long air; the fourth, fifth, and sixth abdominal segments armed with a pair of slender white prolegs; the anal tip conical, and divided ventrally into two stout fleshy claspers, which enable it to move about in the peculiar manner noticed.

Pupa.—Two lines in length, long and slender ribbed, and not unlike a carraway seed in general form and colour. Each pupa is attached to the under-surface of the leaf by a loose silken web, which forms a pad of silken strands, and is further held in position by a number of curved hooks on the anal segments of the abdomen.

General colour, light brown, mottled with greyish brown; viewed from above, the head is produced into a flattened beak-like projection,



LEAF-MINING MOTH.

Batrachedra sp ?

1. *Leaf of plant (Mina lobata) destroyed by moth larvæ.*
2. *Flowers of plant.*
3. *Leaf in its natural state.*
4. *Batrachedra sp.?—perfect moth (enlarged).*
5. *Section of antennæ „ „ „*
6. *Pupa.*
7. *Anal segment of pupa, showing hooks.*
8. *Side view of larva in act of crawling.*
9. *Dorsal view of larva*
10. *Side view of pupa*

curving downward in front, a slightly-raised dorsal ridge running from behind the base of the head to the tip of the abdomen; the back, slightly rounded on either side, with the outer edge of the sides produced into a thin flange or keel down the whole length from the shoulders to the tip of the abdomen, which is marked on the upper edge of each abdominal segment with a black spot; the anal segment divided into two rounded lobes at the extremity; the last three segments provided with a number of curious little curled hooks, thickest on the terminal one, two similar curled hooks on dorsal surface of the thorax, and a curious stout spine-like projection in centre of the dorsal surface of the thorax in front of them. The ventral surface slightly rounded, with the wing-covers, legs, and antennæ closed up together, the latter so long that they reach to the tip of the abdomen.

Moth.—About 4 lines across the outspread wings; general colour, light brown; antennæ, legs, and under-surface of the body, silvery grey. The head is small; antennæ long and slender; palpi small, turning upwards; eyes small, black; the thorax is thickly covered with long downy scales, tinted dark brown at the tips. The fore wings are long and narrow, thickly clothed with pale buff scales interspersed and spotted with black scales, thickly fringed on the inner margins and tips with long feathery down. The hind wings very slender, attenuated at the point, thickly feathered on both sides with light brown down. The legs and rest of the abdomen silvery.

This curious little moth belongs to the family *Elachistidæ*, genus *Batrachedra* Stuint., and is probably an undescribed species.

1. Descriptions of Australian Micro-Lepidotera. Pro. Linn. Soc., N.S.W., Vol. XXII, p. 297, 1897.—I am indebted to Mr. Geo. Lyell, of Victoria, for the reference to Meyrick's paper. Mr. Meyrick (1), dealing with this family, says:—"The species of this family are almost all small, and therefore often neglected. It is probable therefore that very many remain to be discovered, and indeed, I possess specimens of quite twenty species that are not in a satisfactory condition for description. I have, however, recorded here 254 species, almost the whole of which are new to science." He divides the family up into thirty-seven genera, which he tabulates in this paper.

Speaking of the genus *Batrachedra*, he says:—"This genus, represented by a very few species in the main regions, is much more considerably developed in Australia than elsewhere, but are also fairly represented in New Zealand. The species are mostly inconspicuous, and often retired in habit. Imago, with forewings very elongate, narrow, long-pointed; in repose, the forepart is usually somewhat raised, the anterior legs rather withdrawn beneath the body. Larva usually feeding on seeds (in many of the Australasian species, probably on seeds of *Juncus*.") He describes twenty-three species, all of which, with one exception, are new.

Remedies.—Strong tobacco-water sprayed over any plant attacked in this manner has been found to kill leaf-mining flies, and would also destroy these caterpillars. Later on a spraying with Paris green would kill the following brood of larvæ.

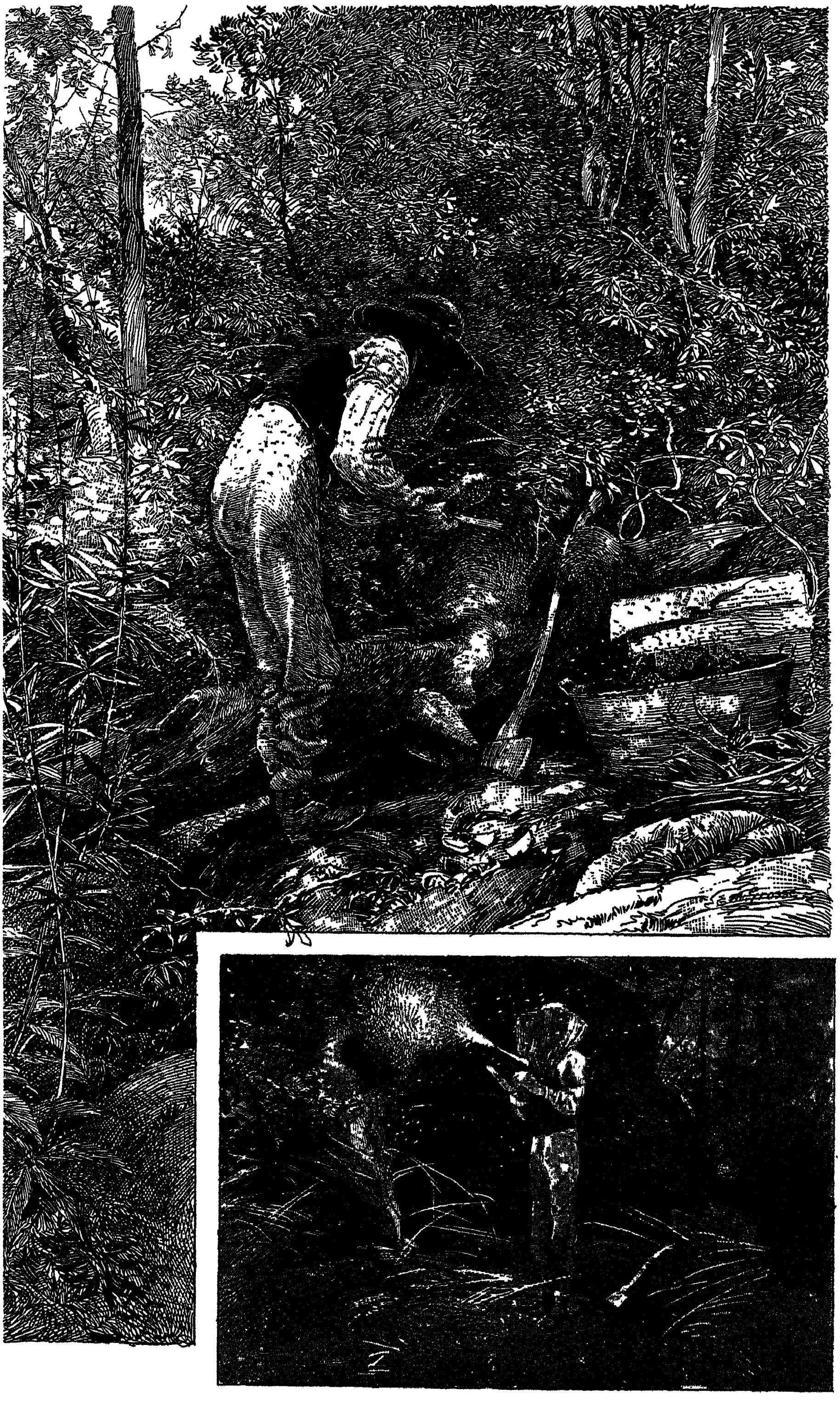
Bees, and How to Manage Them.

ALBERT GALE.

Swarming and Hiving.

PERHAPS the one stage in bee-keeping that requires the least protection and a minimum of courage is "swarm-catching"—that is, taking natural swarms after they have alighted in a cluster on a bush or other object they have chosen for the purpose. To me it is one of the most interesting sights in Nature to watch a swarm leaving the parent stock, rising on the wing, and performing beautiful, mazy evolutions like a country dance mid-air, to the accompaniment of a soft, melodious, gentle hum, so indicative of peace, goodwill, and enjoyment at the prospect of establishing a successful home of their own; the main body keeping up these beautiful movements whilst the scouts are flying hither and thither in search of a suitable spot on which to alight; and then to see them hasten to a bush in thousands, and threading in and out amongst the foliage, now here then there, until the scouts trumpet forth the call to assemble. I have never yet discovered that call, but it must be well known to the bees; for when the spot on which to alight is found, and the call made, you will see all the bees that are on the wing head towards it, even those that form the most distant circle.

When the place of assemblage is found, what a change takes place in their song! from the gentle, peaceful hum to one of ecstatic delight. Note again, if the bees have made up their mind to go farther afield to form a new home, there will be a change in their movements and in their song. Instead of making easy, graceful movements to and fro, the whole swarm will become agitated, the scouts will be called in, and their song becomes one of great disappointment, not to them, but to you, when you see your cherished hope rising in the air like a solid mass, and with a sharp cry and rapid movement they make for—you know not where. "But," you say, "I was given to understand that bees were always led by the queen—that she gave the call, and directed their movements;—is not that why they beat the tom-tom or ring the frying-pan with the door-key?" Not a bit of it. That is an old superstition, grown out of a custom declaring the ownership of a swarm of bees when on the wing. It was equal to the ringing of a bell and saying, "This is to give notice these bees belong to me." I have more than once seen the queen on a leaf some feet from where the swarm was clustering. I have seen her parading too and fro on a rail while the swarm was clustering on the post, the bees paying not the slightest attention to her. At other times I have seen her alight on the cluster and burrow in amongst them. Evidently she had been on the wing for some time after the main body had settled.



TRANSFERRING SWARM OF BEES FROM LOG.

When bees have once clustered they are in the best of temper; you may do almost what you like with them. Frequently, to prove to onlookers the ease and freedom from danger with which you can handle bees under such circumstances, I have bared my arm and passed my hand through to the other side of them. To do so your movements must be slow and gentle. Try it; but, in doing so, don't forget, "Be gentle."

If bee-keeping be indulged in as a hobby, artificial swarming robs it of one of its most interesting and fascinating features.

As a rule, early spring swarms do not abscond on the day they leave the parent hive. Sometimes they will hang for days to the place they first settled on. Early swarms cluster low. The reason is not far to seek. It is the old, pregnant queen that issues forth with the early swarms. She is heavy, and the workers know it. Sometimes bees cluster in the most inaccessible places; against a wall, in the cleft in a log or stump, in between the forks of trees; from such places you cannot shake them. It is under such conditions as these that the amateur's courage and patience are put to the test. How can they be dislodged and put into a box prior to hiving? Sometimes you may dislodge them with smoke. The most effectual way is to remove them with the hand. Place the receiving-box as near to the bees as you can; on the ground is best. Then scoop them up in handfuls, placing the first few handfuls on the ground. Put the receiver over them, resting on a small stone with room enough to give access; then throw other handfuls near the entrance to the box. When you see those you have placed on the ground freely enter the box, those bees you have left behind will soon follow. But if you are present when the bees are on the wing, all this may be avoided: "Prevention is better than cure." When you see the bees have chosen a place of settlement from which it will be difficult to dislodge them, take a leafy bough and quitely move it up and down over the site chosen. They will soon forsake it for one better adapted to your purpose; if not, repeat the action.

If they have chosen a leafy bush on which to settle, boxing them is easily enough done. Place the receiving-box directly under the cluster of bees, mouth upwards; give the bough a sudden jerk; the bees will fall in and around the box. Now turn it over, with the bees in it—of course some will fall out—resting on three little stones. The bees will at once begin entering it; but should they return to the bough, wait till about half are clustered, and shake them again.

Sometimes they are so indiscreet as to select a bough high up out of reach. It is then the swarm-catcher comes in very handy, as will be seen by the illustrations. To your swarm-catcher have other portions so as to lengthen it. These can be made like a jointed fishing-rod, each portion having a ferule on one end. When the bees are so situated, let them well cluster before you use the catcher. Raise the catcher to the swarm till it surrounds them; then, with a sudden jerk, shake them into it. Let it rest for a while somewhere in the locality where the bees clustered. The bees on the wing will soon join those within the catcher. Having secured your bees in the receiving-box—that is, when a half or two-thirds are settled therein—lose no time in

removing the box a few yards away. The bees that have gone back to the old spot—and some hundreds of them will be sure to do so—and those that are on the wing, will soon find it and enter it more freely and much sooner than if it be permitted to remain where they were first shaken.

When the bees are well settled in the receiving-box, don't be too particular if a few hundreds are on the wing; it won't matter. Take them to the hive that is to be their permanent home. Always have an untenanted hive, properly fitted up with starters (strips of foundation comb attached to the top bar of each frame) and put in position so that all the frames will hang perfectly plumb. Remove the cover of the hive and also the quilt; space the frames—no occasion to be too particular just now—bring over the bees in the receiving-box, and tumble them pell-mell on top of the frames (you will see how by referring to the illustrations in last December *Gazette*, 1898). As soon as they are thrown on to the frames they will begin to descend in a moving mass among the frames. Pick up the quilt, place it over the bees that are resting on the frames—it won't injure them—put four stones, one on each corner of it, to keep it from blowing away, and now leave them alone for some hours. Don't wait till night, or even the twilight, as is usual, to do all this. There is no advantage in it that I have ever discovered; but, on the contrary, the bees may abscond if not soon hived. If you have not time to attend to all this, that is another thing. In that case remove the box with the bees to the shade of a bush, or in some way protect them from the direct sunlight, and leave them till you have time. Under no circumstances should the bees be allowed to remain in the box too long. As soon as they have taken possession of a place they at once begin to work. I have seen them, when they have been hanging on a bush or elsewhere for a few hours, leave their mark behind them in the form of small bits of comb attached to where they hung. Before turning in for the night, remove the stones from the quilt and replace the lid of the hive; it will protect them from rain should a shower come on.

On the morrow remove the lid of the hive and the quilt, and have a look at the bees. They are just as quiet to-day as they were yesterday when they were clustered. Note how much room they occupy. If you have not bees enough to fill the whole hive, and it is not likely you will, close them in with a division board, and increase their home as required. It is always a disadvantage to you and the bees for them to have too much room to work in; the reason will be given further on.

If the bees do not appear to take to their home, from some cause unknown to you, or perhaps even to themselves, put in a frame of comb with young brood in it. There will be no absconding after that.

For some reason, bees when swarming take a special fancy to alight on the same spot chosen by a former swarm. My neighbour has a stunted lemon-tree trying to grow in his yard, and for years past the majority of swarms have selected that lemon-tree as a place of rendezvous. Undoubtedly bees leave behind them an odour easily recognised by their brethren of another hive. This may be taken advantage of,

and provision made to meet your bees at such spots. Knowing this trait in their swarming habits, some bee-keepers have turned it to advantage by putting up one or more boxes to serve as decoys. For this purpose they use an ordinary candle-box with one side removed, the remaining sides being pierced with inch auger-holes; it is then fastened to a long, fairly light rod. When the bees are on the wing, this "decoy-box" is held up amongst them. If a swarm has once entered it there is not much trouble to induce others to do so again. I have known a German bee-keeper use such boxes with great success, and as an additional attractive inducement pin a dead queen therein. I have not proved that there are any virtues in the latter to attract a swarm.

I have mentioned in this article several appliances in connection with swarming. You will find that a box to shake them into from the place where they first alight, and to remove them in to their permanent home, the only thing really necessary, and the catcher when the bees settle high in the trees.

(*To be continued.*)

Preventive for Black-spot.

Mr. J. K. Hergenham, of Stony Creek, Bega, writes:—"To prevent black-spot we use a mixture of lime, sulphate of iron, and sulphate of copper. Divide 22 gallons of warm water into three parts. In one dissolve 40 lb. sulphate of iron, in another 28 lb. sulphate of copper, and in the third 22 lb. lime. The three lots are mixed together, when the wash is ready for use, just before the buds burst in spring. All the loose bark is removed from the stems, and the stuff is swabbed on. This wash should not be applied after the buds swell. It has been used here for three years, and is always followed by three sprayings with Bordeaux mixture, with the result that the crop is always sound, and there is no trace of black-spot, which used to be very prevalent in our vineyards." In connection with the wash recommended by Mr. Hergenham it may be mentioned that the simple wash of sulphuric acid recommended by Professor Blunno, in the *Gazette* for July, 1897, will be found equally effective and, of course, much easier to make ready.

Concerning the use of this latter treatment, Mr. N. Garforth, of Sunnyside, Marsden Park, states:—"Last winter I swabbed my vines with sulphuric acid alone, as advised in the *Gazette*, and the grapes and vines were cleaner than ever they were before. Not a speck of the hitherto ever-present black spot was noticeable, and the crop was larger and better in every way."

The Popular Orpington.

[Continued from page 676.]

GEO. BRADSHAW.

Orpingtons in America.

EVER since the poultry export trade attained its present importance, the Government Export Depôt at Darling Harbour has been one of the places to visit by farmers and others coming to the city, the majority wishing to see the operations, and all anxious for information on the subject of poultry-breeding for export and its possibilities, and of these now daily visitors and inquirers many have got some notion that only white-legged fowls are suitable for the English markets, several expressing astonishment at seeing black and even yellow-legged specimens packed for that market, and surprised to hear that the English buyers were just like ourselves; they favour the carcases which have got the meat on. It is true that, all things being equal, white-legged, white-fleshed fowls will fetch a slightly higher price, but no matter how white, should they be wanting in meat properties, those with such in a greater abundance will find the readiest market, and of the enormous quantities of even English-reared poultry which goes to the London markets, only a moderate percentage of such have the favourite white legs, the vast majority of the best French fowls also being dark-legged. Another coincidence is worthy of notice, namely, that the yellow-legged and yellow-skinned Rock and Wyandotte of American origin have of late years been the most popular in English show-pens. But whatever the prejudice in England in favour of white legs and skin, there cannot be a doubt about the American preference for yellow, every one of the numerous and able poultry authorities of that country being strong advocates for bright yellow skin, whether for the roaster, the boiler, or the more youthful broiler; Brahmas, Cochins, Rocks, Wyandottes, and crosses from such being the varieties most largely bred for commercial purposes in that country. Consequently, with this pronounced belief in bright yellow, it is not surprising that the Orpingtons found little favour in that great poultry-breeding country. However, when there is a good thing on the Yankees are soon found to be in it, and realising the increasing popularity of the Orpingtons in England during the past two or three years, several of the American fanciers have made very large purchases in England, the result being that many of the big American shows now make classes for this variety. At the Maddison Square Garden Show, New York City, held on 21st January this year, classes were provided for Buff Orpingtons; several Blacks were also shown. At the Boston Show a few also appeared, while

Washington had a fair entry. At Ontario Show, Canada, sixteen lots of Orpingtons were catalogued, other exhibitions having a fair representation.

Of course, these are but small numbers in comparison with the many hundreds of other varieties, but if the following letter from a large breeder in New Jersey can be accepted as evidence, the popularity of the Orpington in America is assured :—

"A breed of fowls, like a strain of horses or a brand of wine, must have some striking point or points characteristic of no other bird in order to become popular with the poultry fraternity. If it does not have something to enhance its value, it is quickly relegated to the shelf to make room for the next aspirant for popularity, and such has been the fate of a score or more breeds in the past. When England does anything, she never does it by halves, and she certainly has given us the whole thing when she presented us with the latest out in fancy poultry. It is not very flattering to home industry to think that we must cross the water to get our most valuable breeds; but, be that as it may, our English brothers have in this instance presented us with a fine breed, and deserve the credit.

"The breed we have reference to is the Buff Orpington. In form it is a symmetrical, upstanding bird, with a fine, graceful carriage. The plumage is a soft, even buff, with a fine under-colour. The legs are free from feathers, white, strong and of medium length, four toes upon each foot, and white toe-nails. The face is red, comb single, not large, and less liable to freeze than the Mediterranean breeds. The eyes are brown, breast broad, deep and full, with a long, straight breast-bone, skin white, thin and fine in texture. The meat is very juicy and fine-grained, pronounced by epicures to be far superior to all other breeds for table use. The standard weight of cocks is eight to ten pounds, the hen six to eight; the chicks are hardy and mature early.

"The object in forming this breed was to combine prolific egg-producers with superior flesh for the table, hardiness of constitution, rapid growth, fine form and plumage. Possibly when you read of white legs you will say, 'I don't want any white-legged chickens around me'; but the old adage, which runs something like this—

> 'Vice is a monster of such frightful mein,
> That to be hated, needs only to be seen,
> But seen too oft, familiar with its face,
> We first endure, then pity, then embrace.'

covers this case nicely, and this makes the Orpington hold a unique place in poultrydom in this country. There is a widespread prejudice against white-legged fowls here; a very unreasonable one at that. It has prevented a great many breeds from becoming popular; but the Orpington has overcome this with all who have come in contact with it. It has overcome it because you cannot keep a good thing down, and that they are good the following will show. I imported at one time four pullets and one cockerel. These fowls were shipped from the interior of England, and, of course, crossed the Atlantic, were again shipped by rail a distance of nearly 100 miles, arriving here on the 8th day of March, 1898. On the day of arrival one of the pullets laid, and

in the remaining twenty-three days in March the four pullets laid fifty-seven eggs. The following month the egg total footed up seventy-seven, and in May these same birds rolled up a grand total of eighty-two eggs. This is a remarkable showing under the circumstances, but it is characteristic of the breed, and we must venture to predict that they are destined before long to become popular with both farmer and fancier.—C. E. VASS, Washington, N.J."

The above is certainly strong advocacy of a—to an American—foreign-made breed, and that it is not an isolated case the following will show:—During the past year I had a communication from Mr. W. P. Webster, of Gazevona, N.Y., manufacturer of green-bone cutters, as follows: "I am much interested in the English Orpington fowls, and will thank you to supply me with any information you are in possession of in connection with the breed, as I intend booming them. I have had two sittings of eggs from Messrs. Abbott Bros., England, and although three weeks on the voyage, eighteen strong chickens hatched out. I shall be glad of all particulars of the breed." Other like communications have been received from that country, while every issue of Cook's poultry journal record shipments of Orpingtons of all varieties to the States and Canada.

Orpingtons in Australia.

The history of the Orpington in New South Wales very nearly embraces its history in Australia, for although there have been importations from England to the other colonies, and a few good representatives of the breed at their various shows, Sydney and suburbs have been the head-quarters of this variety in Australia, very many of the winners in the other colonies having been bred here.

Some time ago, when discussing the merits of the Orpington with an enthusiastic breeder, I was obliged to correct a very general opinion to which he gave expression, to the effect that, since their introduction to the Colony, no other breed had so "caught on" the public taste, whether those who breed for table or exhibition purposes, and that their show-pen record for numbers exceeded that of any known breed here. My friend was a comparatively new recruit to the Orpington fowl, but, as his opinions are shared by older breeders, it is as well here to dispel the erroneous impressions. Orpingtons, although of comparative recent introduction, are exceedingly popular, and at the present time have possibly more patrons than perhaps any other variety, Leghorns excepted; but other breeds were just as popular, and even as plentiful, as the one under discussion. The poultry fancy is a fitful thing—for a year or a few years one man's name in connection with a breed or breeds may be at the top of a tree for show-pen honours, then he is supplanted by some other fame-seeker. Then both may disappear and new names grace the Society's catalogue as prize-winners, with the result that every few years fresh exhibitors are added to the fanciers' ranks with a proportionate disappearance of the old, it being perfectly safe to say that every half-dozen years fully 50 per cent. of the older exhibitors have tired of their hobby and given place to the new. These facts alone account

for the very general ignorance amongst breeders of simple matters connected with the varieties they patronise, and at the risk of being charged with reiteration, I have again to remark that the poultry fancy is a thing of fashion, and is as changeable. Coin and stamp collecting, and other crazes, have their years or periods of a boom. For a time there may be a run on a coin of a certain date, or a stamp of a particular nationality, then these decline in demand and value in favour of some other allied fad. Just so with breeds of fowls, the past dozen years in the Colony affording ample testimony; hence some later-day Orpington enthusiasts will be surprised to learn that prior and into the nineties Cochins were the hot favourites of the poultry fancy, and occupied pride of place for numbers, over 200 pens of this breed appearing at some of our shows. Some six or seven years ago I made the awards on almost that number in the Exhibition Buildings, Melbourne, and since then their rapidity of decline has been such that only thirty-four appeared at the same Society's show during the past year. Brahmas also had a run for popularity, the numbers in 1890 at the N.S.W. P. P. and D. Society's show reaching 120; nor did the following year witness much decline, a first-prize hen of mine at this same Society's show being sold for ten guineas; this change of fashion being such, that were a bird of like merit now in the market about 20s. would be her value. Then came the Plymouth Rock craze, this being the wildest of all the Australian poultry booms; everybody who knew anything about cocks and hens, and those who did not, had to be in it. Whenever fowls were spoken of, either as a business or a hobby, Rocks were advocated; the excitement over them being such that fanciers were actually competing for who would send the largest amount to England for trios of this breed, and I remember sixteen separate shipments of these fowls arriving in Sydney from England in one season, while this Rock rage became so well known to captains of some sailing vessels and steamers that many consignments were brought out on speculation and found ready purchasers. This variety further attained distinction by making a show-pen record to that time of thirty-three pullets in one class at the Society's show already noted, a position not yet reached by the Orpington, although in 1897, thirty-two Orpington cockerels were recorded at the above show, this number also appearing at the Poultry Club's show in 1898. Rocks are now bred in but moderate numbers, and I fear a still further decline in favour of something newer.

Langshans, like the breed mentioned, have also had their rush, and although the excitement over them never ran so high as with the Rocks, still they were a more generally-bred fowl, both by fanciers and those who kept them for business purposes, than any of the breeds mentioned.

When there is a rush over anything in Australia, be it but cocks and hens or any of the big booms of late years, the Victorians are usually in it early and fast, and, of course, Langshans did not escape; and, to my own knowledge, in that Colony there were instances of men in good businesses neglecting such and going headlong into the Langshan fancy, the majority of them, when a favourable opportunity

occurred, dropping it like the proverbial hot potato, some of these then enthusiasts nursing a grievance against myself for having the audacity to write to the *Poultry and Dog Gazette* of that time that I believed the Langshans had reached the zenith of their popularity, and predicted an immediate decline in favour, which assuredly came.

New South Wales was also in the forefront of the Langshan business, the premier fanciers' society of this Colony, at their seventeenth annual show in 1894, having the extraordinary entry of 38 cockerels competing for a 15s. prize, this being the largest class of any breed of fowls ever competing at any Sydney show, and I feel safe in saying that it will never be again reached, not even by the popular Orpingtons.

British Game had also their feverish time for a few years, 30, 32, and 34 exhibits, of both sexes, frequently appearing in their respective classes.

Of course, did I wish to bring the Orpington into undue prominence, I could have been conveniently silent upon the past popularity of the above breeds, thus allowing a large number of the newer Orpington enthusiasts to remain in the belief that their favourites had attained a position never before reached by any other variety in the Colonies.

And having now removed this erroneous impression, I will proceed to show and trace their growth and history in, at least, this Colony since the landing of the first shipment; and although in show-pen numbers they have not, nor ever may, attain the distinctions credited to the above breeds, still their advance has been extraordinary and satisfactory from the fact that their patrons are not confined to fanciers, but are embraced in the vast majority of those who keep poultry for business as apart from the exhibition; and as it was the pronounced good qualities of the Orpingtons which brought them into the general public estimation, the continuance of such will be the best proof that they possess qualities other varieties were credited with, but, unlike them, they continue to retain these qualities.

The first Orpingtons which reached Australia arrived at the latter end of 1887, and found location at the yards of Mr. R. Graham, Five Dock; and the first of this breed which appeared on exhibition in the Colonies was at a Balmain Show on the 4th July, 1889, and following days, Mr. Graham being the only exhibitor. The N.S.W. P. P. and D. Society, a fortnight later, had its solitary entry, which in the short space of seven years had increased to 106. The next arrivals were imported by Mr. Ferguson, of the then well-known firm of solicitors, Ferguson and Broad, and another lot to the order of Mr. Pemell; these and Mr. Graham's being the progenitors of the New South Wales Orpingtons for the following two or three years, when regular importations began, and have continued to the present day, their popularity being of quicker growth than any other breed; still although, as already said, Langshans have had the largest individual classes at any Sydney show, Orpingtons, with a much briefer history, have beaten them collectively, 106 entries of blacks appearing at the N.S.W. P.P. and D. Society's show in 1896, this being the biggest number ever recorded in the Colonies, the nearest approach being that

of the Poultry Club last year with 91. Buffs have also appeared in the show-pen, and this being now the fashionable colour, rapid increases may be expected, the latter society's show of 1898 having 32 exhibits of this colour, and with a view of showing the growth of this useful fowl since its introduction, and its comparison with two other popular breeds, I submit the following tabulated statement of the entries at the N.S.W. P.P. and D. Society's Show from 1888:—

	P. Rocks.	Langshans.	Orpingtons.
1888	46	16	0
1889	45	19	1
1890	91	39	4
1891	86	52	15
1892	52	44	29
1893	30	61	35
1894	61	82	47
1895	56	66	79
1896	43	82	105
1897	32	34	58
1898	12	44	57

It should be explained that Langshans and Rocks have been on exhibition since 1883, and had a start, with 19 and 45 respectively, in 1889, as against the first and only entry of the Orpingtons, yet in 1895 it will be seen they had actually overtaken both breeds; the following year, 1896, their numbers being more than double that of the Rocks, and far ahead of the Langshans.

With this review of their introduction and growth in this Colony, I proceed in next chapter to give the opinions of a few prominent New South Wales breeders on the characteristics, and useful and other qualities of the breed.

N.S.W. Opinions and Experiences.

From the fact that I have made mention of 106 exhibits of Black Orpingtons at the 1896 Show, it might be inferred that there would be a large number of breeders qualified to give extended reliable experiences and opinions of the breed, but it must be recollected that 100 exhibits may be contributed by less than a fourth of that number of exhibitors, and of these only a small percentage may have experience on which to base opinions of sufficient import to reproduce here. Consequently, the list of breeders from which to make a selection was but a small one, and further reduced by the fact that some of them had contributed to my Wyandotte article, and for reasons apparent have not been requested for assistance here.

Mr. William Graham, of Lyons Road, Five Dock, was the pioneer of the Orpington in this Colony, and has been a continuous and consistent breeder of that variety until the present day, and is well worthy pride of place amongst the contributors, and supplies the following:—"The Orpingtons were first brought to Sydney by a friend coming out from England. They arrived here on 27th November, 1887. I commenced breeding from them early in 1888, and have continued so every year on a large scale until the present time. During the past eighteen years I have kept almost every kind of known fowl, but the equal of the Orpingtons I

have never found. In earlier years I was guided by the eye in my choice of breeds; but of later years I have been guided by the pocket, and Orpingtons are the sort for that. From my first importations the young stock came different colours, some being black and white and some of the cockerels white, red, and black, but with careful breeding I got them to a uniform colour. My object in taking them up was the same as that of Mr. Cook's when he first introduced them—eggs and flesh—and up to the present day I keep on the same lines, breeding only from the largest and best laying hens, and always selecting non-related cocks, as I have found from a life experience that inbreeding in poultry is the greatest evil that can possibly exist. The Orpingtons are of excellent constitution, and I always find the chickens hatch out twenty to twenty-four hours before the time required for other breeds, they grow quickly, and I rarely loose any of them except through accident. The cockerels are a bit slow in fledging. Pullets usually commence to lay from four to four and a half months old if they are hatched early. Some of the past season's pullets began to lay at four months and three days old; but it never seems to check their growth. The hens lay as regularly during July and August as they do through the summer. The hens are good brooders, and generally begin to lay when the chickens are from ten days to a fortnight old, and continue looking after the chickens all the same. I have always found them bear confinement better than any other breed, and they seem contented and happy in small places. I have had them about at different shows for two or three weeks at a time, and when they returned they were as fresh as when they left, while other breeds seemed half dead. If they have their liberty they will work for their living with any other breed. As farmers' fowls I look upon them as the best to be found, being naturally adapted to all conditions of life. They are small feeders, grow quickly, and produce a large quantity of juicy white flesh. I have had the cocks weigh up to 12 and 13 lb. each, and the hens up to 11½ lb. I exhibited the first of this breed that ever appeared in Australia, at Balmain, on July 4th, 1889, this being the first place I could get a class made for the breed. I put in three pairs, and they received great attention from the visitors, and from that on have made rapid headway. I have had a successful career in the show pen, but of late have been selling my best birds to fanciers. I have been getting the money, and they had the credit of breeding them. I have sent eggs and birds to all the colonies, including New Zealand. As I have long since made a name for myself with this breed, I have no need to send to the country shows to advertise, and now confine myself to the leading Metropolitan exhibitions. I kept the Rosecomb Blacks for a few years, but gave them up, as there were no purchasers for them. Buffs being a new variety, my experience of them is, of course, not so extended; but I have paid very close attention to them since their arrival here, on the 6th of June, 1896. I have not kept an account of the number of eggs laid, but they are constant layers all the year round, as regular in winter as in summer. They stand even higher in my estimation than the Blacks, and are the best utility fowl I have yet known. Already I have sold a great number

of eggs and birds, but the demand for them has not yet reached that of the blacks, for the reason that they are not so well known; but the time is not far distant when they will command a great deal of attention, especially from farmers, for they are undoubtedly the farmers' best fowl."

I very well recollect the suburban show where Orpingtons made their Australian *debut*, and have a vivid remembrance of the then new breed, and in discussion with Mr. Graham, opposite the pens where they were exhibited, I remarked to that gentleman that they were a very common looking lot. "That might be," he retorted, but "handsome is that handsome does, and if they are common to look at they are not common as layers; in fact," said he, "they are very uncommon in that respect—they never stop."

The breed was then only two or three years before the public, and type very unfixed. The three pairs exhibited had little uniformity in appearance, while one of the hens, I recollect, had legs almost white. Coming to the progeny from these first importations, the experience of this breeder was exactly as Cook told the public it would be—that they might expect red and other coloured feathers for a time. However, careful breeding has removed all these defects, the magnificent specimens which now appear at our annual shows being a tribute to the breeders' art.

Mr. J. E. Pemell, of Randwick, possibly the most experienced breeder in the Colony, successful exhibitor and judge, writes as follows:—"About the end of the year 1889 I went aboard the ship "Macquarie" to inspect some Plymouth Rock hens, just arrived from England, when the steward drew my attention to a trio of black fowls called Orpingtons. The handsome and very attractive appearance of these birds so won my admiration that I became a purchaser; and although that time of the year was the worst for imported birds to land in this country, the result of several months' trial was so satisfactory that I sent to England for more, and from that until the present day I have been importing, breeding, and exhibiting Orpington fowls; and now, after this ten years' experience, I am able to speak of them as the very best of all the breeds I have kept and known for the past thirty-five years. During that time I have bred and exhibited all the breeds that have been before the public throughout that extended period; and as my Orpingtons have been bred specially for show points, without regard to other properties, and even then have beaten all the other breeds for utility purposes, it can be well understood why I claim for them the right of being far and away the best of all varieties for an all-round profitable fowl. As egg-producers they are specially noted for commencing to lay from eight to twelve weeks before any other breed; and as I always keep records of my earliest hatches, the following extracts from my notes will show their superiority in that respect:—

1895,	hatched	June	18,	layed	October	18
1896,	„	„	10,	„	November	11
1897,	„	May	18,	„	October	10
1898,	„	June	30,	„	November	11.

"The above are the dates when the first eggs of the various broods were laid; the remainder of the pullets commenced immediately afterwards. It will be noticed that the 1895 birds began at exactly four months; but I am confident, had those of the later years been treated to the small daily portion of meat supplied to the 1895 brood, the results would have been the same.

"It is a well-known fact that fanciers prefer the laying of their pullets to be much deferred, thus allowing a greater development of the birds for show purposes, and this was my experience with other breeds; but, to my astonishment and satisfaction, the early laying of the Orpington does not in the remotest way interfere with the growth, many of those with the early-laying records had developed into the finest birds I reared, and were frequent winners at the Sydney and Melbourne shows. As to the general laying qualities, for numbers of eggs, they excel all others—Leghorn excepted. The size of the egg is rather over the average and of the fashionable buff tint, which commands a better price, being much richer than the white egg of the Mediterranean breeds.

"For many years I was a warm admirer of the Brahmas and Cochins, and still think that, for certain points, there are no breeds to equal them—quiet, easily kept within a small space and, with careful feeding, the egg production better than with a good many other breeds. Up to, say, seven or eight months no fowl is better or more juicy on the table; but through a tendency to frequent broodiness (oft times a desirable acquisition) and injudicious feeding they have been much maligned. So, finding that the demand for them was falling off, and believing that competition in the exhibitions with Orpingtons would be very great, and determining that if I kept the breed I would do with it as with all the other varieties—hold the premier position in the show pen—I discarded all others in its favour; and whilst with other breeds I have kept there was always a difficulty in clearing the surplus stock, there is none whatever with the Orpingtons, there being always a ready demand for all the birds of either sex I have to spare—many hundreds of eggs for hatching purposes being also annually sold.

"The Orpingtons develop very quickly. In five or six months the cockerels are well matured, and fit for any market. They are particularly free from disease, and easily reared. They are good foragers, and make an ideal farmer's fowl, hardy, well able to take care of themselves, very good layers, splendid table fowls, and well worthy of the best attention.

"In 1897 I received my first Buffs, and in many respects these are very good fowls, but not in my estimation anything like as good as the Blacks. They are not so large, neither do they develop so quickly, and consequently the cockerels are not nearly so soon ready for the market, nor do the pullets lay so early; and, whether it be an advantage or otherwise, the Buffs are very much disposed to broodiness; in fact, in my long experience with Cochins they were never worse in this respect. But I must say this in their favour, if smaller than the Blacks they are table fowls in perfection—white legs, white flesh, very juicy, good

flavoured meat, and altogether, I consider the Buff variety an acquisition to the Orpington breed. I have only to add that while occupying the premier position in the Metropolition shows, and knowing the excellent qualities of the breed, I have always endeavoured to get them well into the country districts, and to that end have specially favoured those whom I knew to be legitimate farmers wishing to improve their flocks."

Mr. J. J. Roche, of Bay View Poultry Farm, Manly, a successful breeder and exhibitor, says:—"I have kept the single-comb Black Orpingtons now into the sixth year, and in comparison with other breeds, I find them a good all-round farmer's fowl. They get quickly over their moult, and are therefore in a condition to start and continue as winter layers; are good mothers, and not being flyers do well in small yards. The chickens are very hardy, and with judicious feeding are easily reared. They feather quickly, and if well cared for will start to lay at four months old. I have reared a large percentage of Orpington chickens with less mortality than of any other pure breeds which I have kept. My customers consist principally of suburban business men, squatters, River farmers, and many others of late starting to keep a few fowls with a view of increasing their incomes by the sale of a few eggs. When I am asked by my friends or customers as to the best all-round fowls, I recommend Orpingtons, Langshans, and White Leghorns; and if good table fowls are desired, I recommend a good thick-set Australian Game rooster or Dorking. Either of these crossed with the Orpington or Langshan give plenty of flesh for table use. My above remarks about Orpingtons are based on good stock, not inbred, and treated with common sense."

Mr. E. Butcher, of Ernest-street, North Sydney, a well-known breeder and successful exhibitor, supplies me with the following:—"It is now eight years since I received my first trio of imported Black Orpingtons. My experience of them is that they outclass all others as utility fowls, and for that reason I have stuck to them to the present time. For the first two or three years I confined myself to breeding and selling exhibition stock to fanciers. I did not exhibit until 1895, when I did at the N.S.W. P., P., and D. Society's and Melbourne Shows with marked success. To the best of my belief my original stock were the first short-legged Orpingtons to arrive in Sydney, and for that reason were ridiculed by some of the Orpington breeders. However, I believed they were the correct type, and I have now the satisfaction of knowing that those who then detracted the short-legged, wide-breasted types are now its warmest advocates, as opposed to the long-legged, narrow Langshan type. I have always most excellent breeding results, no doubt arising from the fact that I avoid inbreeding, as I never introduce a colonial-bred bird into my yards, my fresh blood always coming from Mr. W. Cook. As I am not obliged to send my stock to the country shows to advertise them or myself, I have a great demand from country fanciers for birds for exhibition purposes. However, the majority of my customers are country people—selectors and farmers,—the large bundle of enclosed correspondence being testimony to the merits of the Orpingtons as

a breed most excellently suited for farmers and others whose object is profit. The Buffs I only took up last year, having received two consignments from Mr. Cook, and although too soon to write of the results, I am more than satisfied with their egg-production and the hardiness and quick growth of the chickens; still, although they may get very plentiful, I do not think their popularity will be so lasting as the Blacks. I do not wish to suggest that Orpington eggs will carry over rough journeys with better hatching results than any other breed, still I am sure the following experience will be of interest to your readers:—Some two years ago a setting of eggs was sold to a settler in Berrica; they went by rail to Narrabri 335 miles, thence by coach to Moree 75 miles, then by trap to Gurrah 32 miles, after this 27 miles by pack-saddle, and finally 4 miles on horseback. Mr. Pitman, the purchaser, wrote to say that people told him he might as well throw his money away as attempt to get eggs such a journey, but was pleased to send the following satisfactory results: Three of the eggs were broken, four addled, one chick dead in shell, five strong chickens hatched. The distance, under 500 miles, is nothing extraordinary for eggs to travel with every hope of successful hatching; the results being remarkable from the fact of the most terrible shaking they must have undergone on that coach, trap, and pack-horse journey of over 140 miles. I have just to add, that I only exhibit at one show in the year, the New South Wales P., P., and D. Society, the majority of my surplus stock being sold to country fanciers; and I believe more good is done to the poultry industry by allowing these people to exhibit at their own local shows and have the credit of their wins, than by sending birds all over the country to snatch chance victories, as is too frequently done. From some hundred of customers in every Australian colony who have purchased Orpingtons, and, consequently, keep them under varied circumstances and conditions, I have their united testimony that, as a profitable breed of fowls, they possess every necessary essential, and unlike many other varieties have come to stay."

In the early part of this article I mentioned that Orpingtons were popular with both fanciers and utility men, and had got into the very furthest settlements in the colony. With this assertion it can be rightly expected for me to produce some testimony from these way-back breeders, and to that end I advertised in the poultry column of the *Daily Telegraph*, asking those who had three or more years' experience of the breed to correspond with me. Numerous replies were received, but, with the exception of some two or three, were useless for my purpose. The greater number of my correspondents had only kept this breed for one or two seasons, and, although all wrote of the good properties of the breed, their experiences were too brief from which to make reliable deductions. One breeder from Forbes wrote: "My Orpingtons were purchased from Mr. ———, and I can safely say they are the best breed yet produced; I get more eggs from six hens in a year than I formerly got from eighteen of the common sort; they suit our district well." A Hay correspondent

wrote: "This district, as a rule, does not suit poultry. During the past half dozen years, I have tried as many breeds, until last season, when I speculated again, and this time tried Black Orpingtons. I am glad to inform you that they are doing well, and seem thoroughly suited for our climate; the hens lay well, and I have no trouble with the chickens." Mr. P. M. James, of Wetherill Park, wrote:—"I have had Black Orpingtons for nine years; I have kept nearly all other breeds, paying good prices and with poor results, thereby thinking poultry-farming a failure. When I saw the Orpingtons at Mr. Graham's, I got some, and I candidly tell you I have been more than satisfied; what turned out a failure with the other breeds, the Orpingtons have made up. I can always have eggs when the neighbours have none. I have a few hens now six years old, and still laying well. For a table-bird, the flesh is white, sweet, and juicy. They will stand more confinement than any other fowl, and are easily kept. They make good mothers, but are a bit clumsy on the nest. They are less subject to disease than any other breed, indeed, I have had no disease in my yards since I did away with all the other breeds. My experience is that the pullets are a bit slow in beginning to lay, but they make it all up once they start. Buffs I have only had two years. I find they commence to lay earlier than the Blacks, but whether they will continue to lay as long as the Blacks I cannot say."

Mr. W. H. Webb, a noted Bathurst breeder, also promised a contribution, but up to the time of going to press such had not arrived.

The above communications are certainly in favour of the Orpington for all purposes, and I have not a doubt but had all the breeders of this variety been consulted the same evidence would be recorded.

I have already mentioned that those who were consulted on Wyandotte fowls would not be contributors to the Orpington; however, admissions were made by two of the breeders which are worth noting here. Mr. Board stated that the Wyandotte could not hold its own with the Orpington. Mr. L. L. Ramsay's statement: "As a farmer's fowl I consider them next best to the Orpington; the latter I consider the king of utility fowls." This expression, however justified, is a little risky to attach to any of our ever-changing breeds, seeing that the most popular sorts now were, by their breeders a few years ago, honoured with this same royal title; and, even admitting the Orpingtons' claim over all others, there is not a doubt but in the future newer breeds will be successful claimants for the title.

General Qualities of Orpingtons.

The above experiences and expressions of a few of the very earliest patrons of this variety are varied, highly interesting, and afford a reliable index to the qualities of this truly popular breed. Mr. Graham, who has bred and exhibited them uninterruptedly from the date of the arrival of the first trio to the present day, and during their ten

years' existence has bred many other varieties, not only side by side but in the same brood, is certainly one whose opinions should be convincing as to the character of the Orpington, particularly as he honestly confesses that business and not amusement is his purpose in keeping fowls. Mr. Graham's statement that Orpington eggs hatch out twenty-four hours before other varieties—whether this be the experience of other breeders or not—may appear of little import, as a day is not much in the life of a fowl. However, the circumstances has a greater bearing than is at first apparent, and goes to prove what William Cook frequently said, "That the material out of which they were made brought vigour and stamina into the breed," the early hatching being no doubt one of the results of this vigour. Their next superiority over many breeds is relative to extraordinary precocity of the pullets, the united testimony showing that at four months many of them commence to lay, and with the usual ordinary care the majority will be laying at five months, this being from eight to ten weeks earlier than most breeds. This early laying being another factor which goes to stamp them as one of the most profitable fowls, for if Orpingtons commence to lay at five months old, while Rocks, Langshans, and others do not start to seven months, it will be readily seen that in the first year alone they have two months more than the other varieties in which to lay, and as forty or fifty eggs would be a fair product for these sixty extra days, the first year's profits alone over the later laying sorts should be from 2s. 6d. to 3s. a head; while a further testimony is supplied by the contributors that as winter egg-producers they head the list. This also being a matter of very much consequence, seeing that for the months of April, May, and the early part of June "shop uns" were quoted from 1s. 3d. to 1s. 8d. per dozen, "new laids" making at the same time from 1s. 8d. to 2s.

Mr. Pemell's poultry-breeding experience extends over a period of thirty-five years, and during that time he has kept every variety, and unhesitatingly says of the Orpington, "they are the best of all the breeds I have kept in that time," and confirms the early-laying properties by supplying five consecutive years' records.

Messrs. Butcher and Roche also confirm the experiences of Messrs. Graham and Pemell. It is, however, worthy of note that while Mr. Graham is enthusiastic over the Buffs, Mr. Pemell only supports them in a half-hearted way, his opinions being shared by Mr. Butcher, who thinks their popularity will not be so lasting as the Blacks, and concludes his contribution by saying that the Blacks have come to stay.

Personally, I agree with both breeders. We may, in a few years, witness the Buff in numbers exceeding the Blacks, but, being birds of colour, the breeding for perfection in this point will, as in other varieties, have an effect for ill, when they will assuredly decline in public favour.

My Forbes correspondent's statement, that his six Orpington hens laid more eggs than eighteen common ones, need not be considered an exaggeration, seeing that the majority of the fowls in the country have not had the benefit of fresh blood for years, and have consequently deteriorated in every essential necessary to profit.

The gentleman from Hay has shown that the vigorous Orpington thrives in that arid country when others have died off; while Mr. James assures us that they are freer from disease than all others, and that what he lost in other classes of fowls, the Orpingtons made it up. Altogether, the testimony of the various fanciers, farmers, and other breeders is overwhelmingly in favour of the Orpington as the best fowl they have ever kept, and although I believe we may never again see over 100 Blacks exhibited in four classes in a Sydney show, as in 1896, yet I fear not but their popularity will still further increase, and that they will become more plentiful with farmers, orchardists, cottagers, and all those who keep fowls as they do other stock—with the object of profit—and it is for these people the Orpington article is especially intended.

Breeders of Orpingtons.

Shortly after the publication and distribution of the Wyandotte pamphlet, numerous inquiries reached the Agricultural Department, requesting information as to where reliable stock of that breed could be obtained, with the additional queries, involving rather diplomatic replies, as to who were the best breeders, and to obviate similar inquiries as to where Orpingtons can be best procured, I append a complete list of every prize-winner in Black Orpingtons at the N.S.W. P., P., and D. Society Show since 1890, when a class was first made for this variety, until the past year. These have all been intercolonial shows, and frequently patronised by Victorian exhibitors, and it is worthy of note that in Langshans, Rocks, Cochins, and other breeds we have frequently been beaten by the Victorians, but in single-comb Black Orpingtons the honors are all held by our own breeders.

For two or three years Black Rose-comb Orpingtons had a struggling existence here, and some of the awards went outside the colony, but this variety has now disappeared from the Society's schedule, and without regret.

When submitting the following list of First, Second, and Third prize-winners, it must not be thought that these are the only breeders. Many other names are annually found in the Society's catalogues, and frequently a fowl honored with only the modest "Commended" may be for show purposes equal to the winner, condition or sometimes an imaginary defect determining the awards. My object is rather to show that in Orpingtons, those who took them up early have been consistent patrons; some of the names appearing in the year of their advent will be also noted in the past year's honors, this circumstance being of rare occurrence in other breeds. I should again remind those who intend going in for this breed, that for profitable purposes a bird that gets a first or any other prize may be for that purpose valueless; at the same time, those who have the best exhibition birds, have usually largely developed stock, and numbers of these, for some outward defect, unfit for exhibition, are excellently suited for the farm, either to breed pure or to assist in improving a flock of ordinary farm-yard fowls, and these wastrels (as they are frequently called) can always be secured at favourable prices.

The following are the Orpington winners at the N.S.W. P., P., and D. Society's Show from the first year of competition in this variety :—

1890.			
Cock and Hen ...	1 R. Graham ...	2 J. E. Pemell.	
1891.			
Cock	1 R. Graham ...	2 R. Graham ..	3 G. Doyle.
Hen	1 J. E. Pemell ...	2 J. E. Pemell ...	3 J. E. Pemell.
1892.			
Cock	1 J. E. Pemell ...	2 J. E. Pemell ..	3 Mrs. Webb.
Hen	1 Mrs. Webb ..	2 J. E. Pemell ...	3 J. E. Pemell.
Cockerel	1 J. Pomeroy ...	2 C. E. Fowler ...	3 J. E. Pemell.
Pullet	1 J. E. Pemell ...	2 J. Pomeroy ...	3 A. C. Tuck.
1893.			
*Cock	1 R. Graham ...	2 Mrs. Tremlett ...	3 R. Graham.
Hen	1 H. M. Hamilton...	2 F. Collier... ...	3 R. Graham.
Cockerel	1 W. M. Richards...	2 R. Graham ...	3 R. Graham.
Pullet	1 R. Graham ...	2 R. Graham.	
1894.			
*Cock	1 L. L. Ramsay ...	2 Kingsgrove Farm	3 Kingsgrove Farm.
Hen	1 Mrs. Collier ...	2 H. M. Hamilton...	3 Kingsgrove Farm.
Cockerel	1 Thos. Hall ...	2 Mrs. Hordern ...	3 W. F. Pole.
Pullet	1 Kingsgrove Farm	2 T. Hall	3 Kingsgrove Farm.
1895.			
Cock	1 E. Butcher ...	2 J. E. Pemell ...	3 L. L. Ramsay.
Hen	1 Mrs. Collier ...	2 L. L. Ramsay ...	3 L. L. Ramsay.
Cockerel	1 J. E. Pemell ...	2 Bonaventure ..	3 E. Butcher.
Pullet	1 A. Kortlang ...	2 E. Butcher ...	3 Stannard.
1896.			
Cock	1 J. E. Pemell ...	2 R. Graham ...	3 R. L. Smith.
Hen	1 Mrs. Collier ...	2 A. Kortlang ...	3 S. Calder.
Cockerel	1 J. E. Pemell ...	2 S. Hordern ...	3 G. Tremlett.
Pullet	1 Bonaventure ...	2 E. Butcher ...	3 W. Cowley.
1897.			
Cock	1 S. Hordern ...	2 E. Butcher ..	3 R. Graham.
Hen	1 H. M. Hamilton...	2 R. Graham ...	3 Mrs. Clay.
Cockerel	1 J. E. Pemell ...	2 J. E. Pemell ...	3 E. Butcher.
Pullet	1 E. Butcher ..	2 W. Cowley ...	3 E. Butcher.
1898.			
Cock	1 J. E. Pemell ...	2 J. J. Roche ...	3 S. Hordern.
Hen	1 W. H. M'Keown..	2 J. E. Pemell ...	3 E. Butcher.
Cockerel	1 R. Graham ...	2 R. Carter.. ...	3 G. Knight.
Pullet	1 J. E. Pemell ...	2 J. E. Pemell ...	3 S. Hordern.

* Mr. Pemell was not an exhibitor these years.

The above show-list is of more interest than is at first apparent, it being testimony to the fact that several of those who exhibited at the very earliest Orpington competitions continue patrons of this variety from its then introduction to the present time; and although then and since they patronised several breeds, have now discarded all others in its favour.

In concluding this paper in the next issue, I shall have something to say concerning Orpington for the local and export market, and some notes on the Orpington duck.

(To be concluded next issue.)

Irrigation in Australia.*

J. L. THOMPSON,
Travelling Agricultural Instructor.

Victoria.

GREAT enthusiasm was displayed in Victoria, about the year 1886, when an Irrigation Act was passed. A Royal Commission had previously visited America, owing to the persistent efforts of the late Mr. Hugh McColl, M.L.A. for Mandurang, who preached irrigation for many years, in and out of season. The Irrigation Act of 1886 empowered the Government to borrow for irrigation works in Victoria 3½ million pounds sterling. The first important feature of this Act is that all waters of the Colony, including rivers, creeks, lakes, &c., are declared to be the property of the State, and to be held and worked by the State, or by Trusts appointed by the State, for the benefit of the people. Thus, what is known as "riparian rights" (the great stumbling block to irrigation in New South Wales) are entirely swept away for ever. Provision was made for National Works and Trust Works.

National works means those works which, in the opinion of the Minister and Parliament, are of such magnitude that they should be constructed by and retained under the control of the State.

Trust works means works undertaken by a Trust appointed by the Minister controlling the Department of Water Supply. There are gigantic national works on the Goulburn River, in the shape of a substantial weir, with a channel on the east side of the river 31 miles long, and another on the west side 24 miles long, capable of conveying 20,000 and 100,000 cubic feet of water respectively per minute. Other works of a national character are being constructed at Kow Swamp, Campaspe, Broken River, Loddon River, and elsewhere. Over thirty Trusts have been formed. The Trusts have power to borrow money and control the water supply. Some splendid returns have been obtained, the results of irrigation. I have seen some fields of wheat under irrigation which yielded ten bags per acre, and where the crop was not irrigated only one bag was obtained. This was on the border near Swan Hill, and we have thousands of acres of the same kind of land in this Colony. Mr. Leitch, Kerang, was among the first to demonstrate the value of irrigation for general farm crops. He produced six bags of wheat per acre on irrigated land in a very dry season, while on land not irrigated only two bags of a much inferior sample were harvested. He produced also 35 bushels of oats per acre, while on the unirrigated land the yield was nil. Mr. Leitch

* Being portion of a lecture delivered by Mr. Thompson at Tumut in February last.

also produced fine crops of lucerne, &c., &c. The late Mr. Gardon, of the same place, obtained 30 bushels of wheat per acre, while the adjoining crops, *not irrigated*, were so bad that the stock were put in to consume them.

Mr. Patchell, also of Kerang, produced by means of irrigation the following results:—

Wheat, from 20 to 45 bushels per acre.
Oats, from 40 to 70 bushels per acre.
Cape barley, 30 to 52 bushels per acre.
Mangolds, 40 tons per acre.
Onions, 20 tons per acre.
Potatoes, 9 tons per acre.
Flax, 2 ft. 6 in. long.
Lucerne, cut eight times per year; also maize.
Sorghum and all kinds of fruits to great perfection and profit.

J. S. Angas, of Mincha West, produced six bags of oats per acre, while unirrigated land of the same quality only produced one bag per acre of a much inferior sample.

D. Milburn, of Grange Farm, Keilor, near Melbourne, sold in Melbourne £1,000 worth of fruit from 20 acres of land under irrigation.

Mr. O'Connell, of Bacchus Marsh, a much moister district than Kerang, produced, by means of irrigation, immense crops of wheat, barley, oats, chicory, beets, mangolds, potatoes, carrots, cabbages, &c. Lucerne was cut four times, and yielded 4 tons per acre of hay per annum.

Mr. Palmer, of Clyde Bank, fattened ten sheep per acre on irrigated land, but on land unirrigated he could only carry one sheep per acre.

Mr. Kavanagh, of Lake Eric, Mooroopna, irrigated 60 acres of lucerne in November. In fourteen days the lucerne was 14 inches high. He applied water to the paddock three times, giving it 3 inches all over each time, with the result that he fattened fifteen sheep per acre, and that at a time of the year when the country for miles around was dried up, and not a particle of grass for stock anywhere, except under irrigation.

Mildura.

Gigantic efforts in irrigation were commenced at Mildura about the year 1886.

The Chaffey Bros. obtained certain concessions from the Victorian Government, on condition that they fulfilled certain obligations in connection with the establishment of an irrigation colony. Everything went on well for a time, and a large number of highly respectable settlers from all parts of the world were attracted to this settlement. They were mostly inexperienced in the art of irrigation and successful fruit-growing; and this, together with the failure of water-supply to the planted blocks at a critical period, caused general disappointment. The management was taken out of the hands of the Chaffey Bros., and the firm financially collapsed. The reasons of the failure may be

briefly stated as—(1) Want of capital; (2) errors in laying out the settlement—want of compactness; (3) indiscriminate sale of land; (4) seepage from main channel; (5) bad stocks, insufficient water supply, and defective means of communication, and the want of experience as far as the settlers themselves were concerned.

The collapse of Chaffey Bros., however, does not imply the failure altogether of Mildura as an irrigation settlement. Although the greater portion of the planted land cannot, as yet, be said to be in full bearing, some of the settlers have made substantial profits during the last two or three years; as much as £430 has been realised from a 10-acre block.

The quality of the raisins, dried apricots, canned peaches, and other fruits cannot be excelled. The olive also flourishes at Mildura, and excellent oil is now being made. The fig also grows remarkably well, and the prospects of some of the settlers are very good.

New South Wales.

Irrigation in this Colony has never been put on a proper basis. A Bill was prepared by Mr. Lyne in 1892, entitled the "Water Conservation Bill," but was not passed by Parliament. This Bill dealt with the definition of water-rights, national administration, local trusts, drainage works, navigation, &c.

Before irrigation can be successfully adopted, a Bill, similar to this, must be passed by the Legislature. In many parts of New South Wales irrigation is carried out with great success. Mr. H. G. M'Kinney, Chief Engineer for Water Conservation, has stated, "there was certainly abundant evidence that the pastoralists were not wanting in enterprise in providing water for irrigation."

During the years 1889, 1890, and 1891 prizes were awarded by the Government for the best irrigated farms and orchards. The competitors west of the Dividing Range represented properties on the Namoi, Lachlan, and Murrumbidgee Rivers; those east of the Dividing Range represented the Hawkesbury, the Parramatta, and the Bega districts. The properties which were entered showed in a number of instances a highly creditable class of work, and showed also that irrigators had the ability and judgment to select the methods best adapted to their circumstances.

The Municipal Councils of Wentworth, Hay, and Balranald have been constituted an Irrigation Trust by a special Act of Parliament; and it is anticipated that highly successful operations will soon be carried out.

The value of irrigation to the pastoralists of New South Wales cannot be over-estimated; the risks of pastoralists from droughts is very great. Land in the Lower Darling, in its natural state, can scarcely support one sheep to 10 acres; but is capable of supporting more than twenty sheep to 1 acre, when laid down in lucerne and irrigated. The capabilities of irrigation in New South Wales are simply immense. The great rivers of the western watershed of the Great Dividing Range

are the Darling, Lachlan, Murray, and Murrumbidgee; the Tumut, a tributary of the Murrumbidgee, 80 miles long; Namoi, 600 miles; Bogan, 450 miles; Gwydir, 445 miles; Barwon, 510 miles; Castlereagh, 365 miles; McIntyre, 350 miles; Macquarie, 750 miles; Warrego, 100 miles; all tributaries of the Darling which flows into the Murray, 300 miles below Albury. The Murray, with the branches mentioned, drains fully 500,000 square miles. It must be ranked with the large rivers of the world, and will, in the future, exercise a most important influence on the destiny of the Colony. In itself, it is 1,120 miles long, and navigable over 1,000 miles in ordinary seasons. The Murrumbidgee is navigable for 700 miles; the Darling, 1,700 miles.

It has been estimated by an enthusiast in irrigation that if 1 mile on each side of the great river Darling were cultivated, and sown with lucerne under irrigation, it would produce as much fodder as would save the lives of the large number of sheep that we lose every period of drought.

Mr. Gatenby, at Jemalong, on the Lachlan, has demonstrated the value of irrigation in growing large crops of lucerne, and storing it away in silos and stacks, enabling him not only to save the lives of his sheep, but actually fatten them at a time when there was no vegetation about.

A few Practical Hints on Irrigation.

A cubic foot of water is equal to $6\frac{1}{4}$ gallons, or $62\frac{1}{2}$ lb.; an inch of water over an acre of land will weigh 100 tons; one inch of water or an inch of rain means $22,687\frac{1}{2}$ gallons per acre; 3,630 cubic feet weighing about 100 tons; a gallon of water weighs 10 lb.; a miner's inch of water running from a hole 1 inch square with a head or pressure of 6 inches.

The Importance of being able to take Levels.

Levels are sometimes very deceiving, and water can sometimes be brought to a point, by gravitation, that one would consider almost impossible by casual observation. I was able to utilise a fine stream in South Australia, by the aid of a plough-furrow and proper levels, that formerly used to run uselessly into the river Torrens and on to the sea.

First of all, the water must be raised to the highest point of the land to be irrigated. The proper grading or levelling of the land is of the utmost importance. If water is allowed to flow on to unlevel land it will lie in the hollows, and soak into the soil and injure vegetable life, while other portions of the land will not be irrigated at all. One is often deceived by the apparent levelness of land, and finds out the mistake when the water is applied.

The buck-scrapers introduced by Mr. W. J. Allen are great aids in levelling the land. Small blocks are easier irrigated than large areas. It is essential to have a good head or flow of water, so as to cover the surface rapidly. Small trickles from a windmill pump are of little use for irrigation. A windmill certainly may be used

for raising water for irrigation, but it is necessary to have a reservoir of some kind so as to ensure a good head. The plough and earth-scoop will be found useful in preparing the land for irrigation.

Too much irrigation is worse than no irrigation at all. There is a Spanish proverb in connection with irrigation which reads as follows :—

"In Valentia the flesh is grass,
The grass water,
The men women,
And the women nothing."

Too much water should not be used for young trees, as it has a tendency to cause the roots to grow laterally near the surface, and they do not go down to seek the natural moisture in the soil. Water should never be allowed to go near the stem of the tree. This often produces collar-rot, or gumming in the case of citrus-trees. It is much better to make a trench right round the tree, 4 feet from the stem. It is here that the water is required, and where the fibrous roots will be found. There are no fibrous roots close to the stem, and it is the fibrous roots which absorb the water. The plan should be to send the roots out in all directions, so that they secure a large feeding area.

When you do irrigate do it thoroughly. Let the ground have a soaking that it will appreciate. Never water unless it is required. With regard to watering flowers, do not sprinkle plants once or twice a day—that is one of the greatest evils that can possibly befall them, as it stimulates the leaves in an unnatural way; the sun acts with double force; the roots are overtaxed to keep the leaves from wilting, and the plant in its weakened condition sends out a poor straggling growth.

Water should not be allowed to lie on the land during the heat of the noonday sun.

An instance of this kind occurred at Swan Hill, on the Lower Murray. A lucerne crop was flooded one very hot day, the result being that it was killed. The roots presented the appearance of boiled parsnips; the injury being caused by the great heat of the water, owing to the powerful rays of the sun acting on it as it slowly flowed in a thin layer over the ground. Land will absorb a large quantity of water when first irrigated, but less will be required as the subsoil becomes saturated. A system of drainage in connection with irrigation is essential.

As a general guide, the following quantities of water will be required for the undermentioned crops :—

Lucerne	... 2½ inches every 15 days.	Total, 35 inches.
Cereals	... 2 ,, ,, month.	,, 9 to 12 inches.
Pasture	... 2 ,, ,, fortnight.	,, 30 ,,
Potatoes	... 20 ,, applied mostly before formation of tubers.	
Maize	... 3 ,, every 15 days.	
Sugar-cane ...	... 50 ,,	
Oranges	... 40 ,,	
Vines	... 15 to 20 inches.	

Thorough Cultivation necessary in connection with Irrigation.

As soon after irrigation as the land will carry a horse without sinking, the horse-hoe or other implement should be used to cultivate the land to prevent a hard crust from forming. Under good cultivation less water will be required.

The manurial value of some of the waters of our rivers is very considerable, containing nitrogenous matter, phosphoric acid, potash, and lime, but this will not compensate for the extra crops produced by irrigation. There is no gainsaying the fact that with irrigation the land becomes sooner exhausted; and, therefore, a judicious application of fertilizers is requisite to make up for the heavy drain on the resources of the land by luxuriant crops.

Sub-irrigation.

There is no doubt that this system has many advantages over surface irrigation. First, the water is supplied at the very place where most wanted by the roots of plants—there is no loss by evaporation. There is no crusting of the surface, and great economy in water. Sub-irrigation has been successfully carried on in California; the only drawback to it is the expense. Mr. A. Frazer-Hill, of Waverley, has under consideration an improved method for sub-irrigating and draining land for cultivation, which I have no hesitation in stating is on truly scientific and practical lines, and can be carried out in a most economical manner.

Irrigation from Artesian Bores.

No one can doubt the value of irrigation from this source of supply. We have in this Colony already nearly fifty million gallons of water rising to the surface from artesian wells every day. This would every day fill a channel 2 miles long, 60 feet deep, and 10 feet wide. The success of the Pera Bore Farm is well known. Where no vegetation exists around without irrigation, magnificent crops of maize, sorghum, millet, lucerne, grasses of all kinds, fruit of all kinds grow to the greatest perfection, and it has been proved that a settler can make a good living on 20 acres by means of irrigation, when, without, he could not make a living on 20,000 acres. Although most of the artesian waters have been proved to be suitable for irrigation, there are some charged with deleterious salts that it will be necessary to experiment with with caution. Although the Special Irrigation Commissioner, Colonel Home, did not give very much encouragement as to the success of irrigation in New South Wales, I am strongly of opinion that by properly conserving water, and by the construction of weirs, irrigation will play a most important part in the advancement of agriculture in this Colony.

Practical Results from Irrigation in South Australia.

During the month of March, 1881, I paid a visit to the Beefacres Estate, South Australia, with a view of entering into an engagement with the proprietors (Messrs. Hart Bros.) to become their manager.

The estate comprises an area of 3,500 acres of rich agricultural land, situated only from 3 to 4 miles from the city of Adelaide, in an easterly direction. At the time of my visit the weather was remarkably hot and dry, and all vegetation burnt up. The land surrounds the beautiful Hope Valley Reservoir, which mainly supplies the city of Adelaide with water, and from what is termed a leak in the embankment a stream was running sufficient to fill a 5-inch pipe at a high level right through the Beefacres land. No one used this supply for irrigation; and on it ran—first into the river Torrens, and thence into the Southern Ocean—uninterrupted.

Before the reservoir was constructed, no water flowed in this natural channel except after heavy rain. Although most people called it a leak, it would not have been wise to say so to the Hydraulic Engineer's Department, who constructed it. However, the fact remains that no water flowed before the said reservoir was in existence; but ever since, a stream equal to irrigating a good-sized area of land. No leakage could be found in the well-constructed embankment, and the water burst out as from a sort of spring, about 3 chains away from the bank. The Government had the water analysed and compared with that in the reservoir, and reported that it was not the same. This, however, could be accounted for from the water being forced through strata impregnated with chemical elements. The higher the water level of the reservoir the better was the stream, and *vice versâ*. At this time, Messrs. Hart's manager had a horse pumping water from the river Torrens to supply the orangery, orchard, vegetable garden, stables, and house, although this beautiful stream was running to waste. And I made a mental resolve that if ever I went to Beefacres, I would very soon profitably utilise this water for irrigation purposes. I did go to Beefacres, on the 1st May, 1881; and long before next summer the horse-pump was stopped, the water was connected, by means of a simple plough furrow, to the pipes already laid throughout the orangery, the vegetable garden, orchard, stables, and other places, besides an ample supply to irrigate a nice alluvial flat of 12 acres.

The subsequent success of the scheme has been fully demonstrated in the public press of South Australia, and by the number of prizes obtained at the shows of the Royal Agricultural and Horticultural Society of South Australia. It will be remembered also that Beefacres was awarded the £100 prize at the Centennial Exhibition, Sydney, 1888, for the best collection of farm and garden produce in all the Australian Colonies; also £50 for the best collection outside of New South Wales; and numerous other prizes, netting a total of £188. This extraordinary result could never have been achieved if it had not been for the system of irrigation referred to.

The soil is of a dark colour, mostly composed of alluvial deposit resting on a gravelly subsoil, and the majority of crops withstood the effects of almost any quantity of water. The crops grown, of mangolds, beets, turnips, cabbage, carrots, onions, thousand-headed kali, rye grass, prairie grass, and trifolium incarnatum, were very fine indeed. The crop of mangolds was immense, averaging sometimes 60 tons per acre for those, and also all kinds of green fodder. I invariably carried

off the lion's share of the prizes at the Adelaide shows, although I had to compete with the Government Sewage Farm. The only failure I had was with a fine crop of kidney potatoes. The crop of 6 acres came up uniformly and well; but towards the middle of September dry weather set in, and the crop suffered severely in consequence. The tubers at this time were about the size of marbles, and I thought by applying water to them at this juncture they would swell into large potatoes. I therefore gave them a thorough soaking, and was mortified to find that instead of the tubers growing larger, a mass of white stringy suckers grew from them in every direction, and the whole crop was useless and had to be given to the pigs. I found out, by a dear experience, that potatoes would not admit of irrigation at this stage, but would stand any quantity of water before the tubers had commenced to form, and even by thoroughly saturating the ground before planting would ensure during the summer months a first-class crop. In the 12-acre paddock before mentioned, two, and sometimes three, crops were obtained within the limits of twelve months.

First, a crop of barley, rye, and vetches was sown on the 1st of April, and cut in October, yielding 10 tons of green fodder, which was generally converted into ensilage. The land was afterwards immediately ploughed, and a crop of maize planted. This was fit for putting away in the silo during January, yielding generally not less than 20 tons per acre, *i.e.*, equal to 30 tons of green fodder per acre from the two crops. This will keep three cows for twelve months, supposing a cow eats 60 lb. per day. Now, the average produce of an ordinary milch cow is not less than 547 gallons per annum; the total produce of the three cows would be 1,641 gallons, which, at 6d. per gallon (certainly not too high a price for milk near a city), would give a gross return of £41 per acre.

The three crops were obtained during the limits of one year as follows:—In May, 1882, a crop of 5 acres of vetches, barley, and rye was sown. This was cut during September, yielding 12 tons per acre of green fodder. The land was at once ploughed deeply, and heavily manured with farmyard dung, and on October 2nd a crop of horse-tooth maize planted. This was cut green for stock the following January, yielding 50 tons. Immediately this crop was removed, the land was again deeply ploughed, and 6 cwt. of fine bonedust applied per acre. The ridges were prepared and the land thoroughly saturated with water, and, on the 4th February, planted with kidney potatoes. This time they were a great success, yielding a magnificent crop of excellent tubers, which realised a high price.

The advantages of irrigation when properly applied can hardly be over-estimated; and considering the great interest at stake in the matter, I think more attention should be paid to this important subject.

Wheat Crops at Wagga Farm.

RETURNS OF THE HARVEST FOR THE SEASONS 1897 AND 1898.

1897.—*After first winnowing.*

Variety.		Area. a. r. p.	Yield.
Allora Spring	Manured	89 1 38	Nett, 397 bhls.
,, (sown July)	Unmanured	27 2 33	Gross, 252 ,,
Zealand	,, ...	20 1 9	,, 108 ,,
Steinwedel	,, ...	9 3 4	,, 10 ,,
King's Jubilee	,, ...	3 3 8	,, 5 ,,
Velvet Pearl	,, ...	4 1 11	,, 10 ,,
Steer's P.S.	,, ...	12 2 8	,, 88 ,,
Leak's R.R.	,, ...	6 0 0	,, 36 ,,
French Early Bearded	,, ...	6 0 0	,, 14 ,,
Tardent's Blue	,, ...	6 0 0	,, 20 ,,
White Tuscan	,, ...	6 0 0	,, 28 ,,
Early Baart	,, ...	6 0 0	,, 38 ,,
Farmer's Friend	,, ...	6 0 0	,, 40 ,,
New Red Wonder	,, ...	6 0 0	,, 26 ,,
White Essex	,, ...	6 0 0	,, 38 ,,
Marshall's No. 8	,, ...	6 0 0	,, 32 ,,
,, No. 3	,, ...	6 0 0	,, 80 ,,
Zealand	,, ...	6 0 0	,, 32 ,,
Venning's Rustproof	,, ...	6 0 0	,, 51 ,,
Blount's Lambrigg	,, ...	6 0 0	,, 30 ,,
Belatourka	,, ...	4 2 34	,, 26 ,,
Fultz	,, ...	6 0 0	,, 24 ,,
Polish	,, ...	6 0 0	,, 36 ,,
Improved Fife	,, ...	6 0 0	,, 44 ,,
Talavera de Bellevue	,, ...	6 0 0	,, 34 ,,
Canning Downs	,, ...	2 2 0	,, 26 ,,

1898.—No. 2 Paddock.—Previous crop, Barley, grazed off; Wheat and Oats previous year to Barley.

Date.	Variety.	Area. a. r. p.	*Grain Yield. bhl. lb.	Hay. t. c. qr. lb.	Remarks.
April 25–29	Farmer's Friend	31 0 8	16 40	....	Balance cut for hay; fair grain.
,, 30 } May 3 }	Marshall's No. 3 Purple Straw	21 1 13	18 0	....	Poor grain.
May 4–5 ..	Marshall's No. 8	14 3 30	73 28	....	Medium grain.
,, 6 ..	Early Lambrigg	3 1 30	6 24	....	,,
,, 6 ..	Late Lambrigg	2 0 16	3 20	....	,,
,, 7 ..	Blount's Lambrigg	9 2 16	26 44	....	,,
,, 7 ..	White Essex	5 2 8	..	1 11 3 14	....
,, 8 ..	Tardent's Blue	4 2 29	5 28	....	Pinched badly.
,, 9 ..	Hudson's Early Purple Straw	6 0 33	8 14	....	Good quality.
,, 13, 14	White Lammas	9 2 35	....	2 16 3 24	....
,, 17 ..	White Naples	5 0 27	....	1 5 1 8	....
,, 18, 19	Talavera de Bellevue	9 2 18	35 6	....	Badly pinched.
,, 23, 24	Red Straw	9 0 8	17 50	....	Poor grain.
June 1 ..	Ward's Prolific	6 0 0	10 2	....	,,

All more or less destroyed by hot winds; unmanured.

* From 6 acres.

Subsoiled just prior to sowing; not manured.

Two comparative plots sown side by side, as described, No. 1 subsoiled about 14 inches, No. 2 ploughed in ordinary way. This land had not been subsoiled previously.

Date.	Variety.	Area.	Grain Yield.	Straw.	Remarks.
		a. r. p.	bhl. lb.	cwt. qr. lb.	
July 14 ..	(1) Early Baart	0 2 0	2 22	4 0 18	Poor grain .. .. All more or less destroyed by hot winds.
„ 14 ..	(2) Early Baart	0 2 0	2 46	3 3 22	„ .. ..

Land harrowed and seed sown with drill. In all respects but ploughing treated alike. No land in which wheat was sown had been previously subsoiled.

Previous crop, Wheat, of same varieties.

Date.	Variety.	Area.	Grain Yield.	Hay.	Remarks.
		a. r. p.	bhl. lb.	t. c. qr. lb.	
June 1–3 ..	Allora Spring	20 1 0	....	....	Grazed off; unmanured at any time.
„ 3–4 ..	Steer's Early Purple Straw ..	12 2 0	8 34	....	Poor grain.
„ 6 ..	Velvet Pearl	4 1 11	....	....	Grazed off; manured by Dr. Cobb. Part of Allora Spring, with part of No. 1, stripped, for 5 bags; 89 acres manured by Dr. Cobb. Previous yield, 4 bushels 26 lb. per acre. Manured by Dr. Cobb, 200 lb. per acre.
„ 6–11	Allora Spring	89 2 0	....	....	
„ 13 ..	King's Jubilee	3 3 8	....	....	Grazed off; manured by Dr. Cobb.
„ 14 ..	Steinwedel	9 3 4	....	....	„ „ „
„ 18 ..	Zealand	20 1 9	....	8 3 1 10	One-fourth of the area not manured; the balance treated with 75 lb. B super. per acre.

Manured Crops (No. 4 on list excepted).

Previous crop, Sorghum.

Date.	Variety.	Manure per Acre.	Area.	Grain Yield.	Straw.	Remarks.
			a. r. p.	bhl. lb.	c. qr. lb.	
June 24	1. Australian Talavera..	75 lb. C.S.R. Co.'s B superphosphate.	3 0 0	12 28	27 1 14	Grain medium. All injured by hot winds.
„ 24	2. „ ..	75 lb. C.S.R. Co.'s No. 1 superphosphate.	3 0 0	14 28	24 1 30	
„ 24	3. „ ..	112 lb. Thomas phosphate.	3 0 0	13 12	23 2 20	
„ 24	4. „ ..	No manure	3 0 0	11 48	16 2 6	
„ 28	Golden Drop	75 lb. C.S.R. Co.'s B superphosphate.	1 2 0	11 10	15 2 0	Grain fair.
„ 28	Grosse's Prolific.. ..	„ „ ..	1 0 0	5 22	5 1 0	Grain medium.
„ 28	Algerian	„ „ ..	1 0 0	....	12 0 0	Grain worthless.
„ 28	Medeah	„ „ ..	1 0 0	....	12 2 0	
„ 28	Early Baart	„ „ ..	1 2 0	....	7 2 0	
„ 28	Canning Downs.. ..	„ „ ..	2 0 0	....	......	Failed.

Rainfall for the years 1897 *and* 1898.

Months.	1897. Points.	1898. Points.
January	427	23
February	20	193
March	54	8
April	1	41
May	6	116
June	159	196
July	212	164
August	212	151
September...	241	71
October	130	239
November...	52	92
December	76	139
Totals	15·90 inches.	14·33 inches.

Rainfall for the months of August, September, and October, 1897 *and* 1898.

1897.

August ...	212 points—	14 wet days.
September ...	241 „	8 „
October ...	130 „	10 „

No further records.

1898.

August	2	2 points.
„	3	14 „
„	5	12 „
„	16	42 „
„	28	9 „
„	31	72 „
		151 points.

1898.

Sept.	1	7 points.
„	5	28 „
„	8	8 „
„	18	15 „
„	27	13 „
		71 points.
October	15	19 points.
„	20	15 „
„	21	57 „
„	27	88 „
„	28	20 „
„	29	36 „
„	30	4 „
		239 points.

[These returns of the harvests of the years 1897 and 1898 at the Wagga Experiment Farm show unmistakably how disastrous were the droughts there of those years. There is little more to note beyond the fact that it is more than probable that the smaller rainfall by 1½ inches of 1898 as compared with 1897 is less responsible for the great inferiority of the harvest of the former year than the fact that this deficiency occurred during the critical time between the 1st of September and the middle of October. It will always be found that a short rainfall at that time of the year will lead—at any rate, in all but our very late districts—to a light harvest, however abundant the rainfall may have been previously; indeed, when I visited the Wagga Farm in the middle of last September, the crops were looking so promising that we all expected the yield to be the heaviest that had been secured since the Farm was established; but the deficient rainfall at the critical time, followed as it was by an unusually early occurrence of hot winds, led to the reverse.

It will also be noted that in 1897 the light rainfall of October led to a failure of the wheats which were sown late that year. A failure from this cause of late-sown wheats will be found to occur in a great majority of years.—W. Farrer.]

Some Experiments in Spraying and Fumigating for Red and other Scales on Citrus-trees.

W. J. ALLEN.

UNTIL recently many orchardists have ridiculed the idea of either spraying or fumigating for the destruction of red and other scales, contending that these pests would disappear suddenly in the same way as they came, and this without any aid. This theory of late has lost ground, and many of those who would not hear of doing anything towards destroying their orchard pests have latterly of necessity turned their attention towards spraying; unfortunately, however, not before their trees and fruit were so badly affected that for this year at least it was found impossible to clean the fruit, although many succeeded in killing most of the scale on both trees and fruit. There are some growers who still hold that it does no good, and these I may say are the persons who have not tried spraying at all, or perhaps expected that one spraying would clean their orchards, whereas it has been proved that it will take about six sprayings to keep orchards in the coastal districts clean, while in the interior from one to two will generally be found sufficient. Some of the cleanest citrus fruits I have seen this year were grown in the hot, dry climate of the interior, where the trees did not receive a single spraying, and yet the fruit was perfectly clean and fit to place on any market.

Growers are now endeavouring to ascertain which are the best solutions with which to spray, and for this reason it was deemed advisable that a series of experiments should be carried on with the different solutions, and showing the results after each application. These experiments were carried out at Galston, in the orchard of Messrs. Rogers Brothers, by Mr. Chomley, an efficient officer of the Department, who was deputed to mix and spray a number of trees with each of the following solutions, viz., kerosene emulsion, starch, blue oil emulsion, McDougall's compound, coccocide, resin, soda and

Fig. 1.—Placing tent over tree to be fumigated.

whale oil soap, and flour-starch. The following is Mr. Chomley's report after we had inspected the trees on 7th June :—

No. of tree.	Spray used.	Strength of spray.	No. of times sprayed.	Percentage of scale found dead on 7th June.	Remarks.
1, 2, 3, 4	Kerosene emulsion.	1 to 15	Once .	per cent. 5 to 10	Showers fell during the night after spraying.
5, 6, 7, 8	,, ..	1 to 10	,, .	5 to 10	,, ,,
7, 8	,, ..	1 to 10	Twice..	25	Second spraying seven days after first.
6	Starch ..	1¼ lb. to 4 gals.	Once ..	25	The starch did not stick well to the greasy leaves.
9, 10, 11, 12	Blue oil emulsion.	1 to 15	,, ..	25	
13, 14, 15	McDougall's compound.	1 to 50	,, ..	No effect.	
16, 17, 18, 19, 20	Kerosene emulsion.	1 to 5	,, ..	5 to 10	This strength had no more effect on scale or foliage than the weaker solution.
21, 22, 23, 24, 25	Coccocide ..	1 to 30	,, ..	20	
26, 27, 28, 29, 30	Resin ..	Mr. Allen's formula.	,, ..	30	
26, 27, 28	,, ..	,, ,,	Twice..	75	Two sprayings so close together are not to be recommended.
31, 32, 33	Starch ..	1¼ lb. to 4 gals.	Once ..	20	Mainly useful for removing "soot fungus" and scale from the leaves.
34	Flour-starch	½ lb. to 1 gal.	,, ..	......	Made a dirty film on the fruit.

I might remark that these experiments were carried on at least six weeks too late to obtain best results. It will be seen that the special resin-wash gave best results. Instead of our using 6 lb. of caustic soda (70 per cent.) we used 8 lb. This strength, however, will occasionally be found too strong, particularly where the trees are not in a healthy condition, in which case it would take off many of the leaves. For this reason I have always recommended the 6 lb. formula, as this has never been found to damage a tree when properly mixed and applied.

I may say that several showers fell during the time of these experiments, and notwithstanding this, and also the lateness in applying the sprays, the results obtained from resin-wash, blue oil, and coccocide were very satisfactory.

Experiments carried on at the Hawkesbury Agricultural College a month or six weeks earlier gave much better results. The wash used was the resin and soda, and was made with 20 lb. resin, 8 lb. caustic soda (70 per cent.), and 1 gallon of fish oil, mixed as follows :—The caustic soda is first dissolved in about 16 gallons of water, after which half of the solution is taken out and the resin added to that remaining in the copper. When all the resin is dissolved, the fish oil is added and the whole thoroughly stirred, after which the balance of the caustic soda solution is added very slowly and boiled for about one hour or until it will readily mix with water. Add enough water to make 100 gallons.

Mr. Alford, the orchardist, applied these sprays, the first spraying killing about 45 per cent., the second 90 per cent., and a third spraying

will kill all that it is possible to kill by spraying. It should always be remembered that when caustic soda is mentioned it is the common (70 per cent.) and not Greenbanks' concentrated which is very much stronger, and in consequence about one-third less of it should be used.

On the 8th and 9th of June last, I experimented at the Hawkesbury Agricultural College orchard, and also in the orchard of Mr. McMahon, of Lower Kurrajong, fumigating the citrus-trees with hydrocyanic acid gas, choosing the worst trees I could find upon which to experiment. The trees at the Hawkesbury College orchard, on being measured after the tent had been adjusted, were found to be 27 feet from ground to ground—that is over the top of the tent—with a circumference of 32 feet. This, I should say, is about the average size of a tree in the Cumberland district, and I charged the generator in the tent which covered it with the following proportions:—6 oz. cyanide, $8\frac{3}{4}$ fluid oz. sulphuric acid, and $13\frac{1}{4}$ oz. of water. Another tree, measuring 24 feet from ground to ground over the top of the tent, and with a circumference of 27 feet. I charged the generator under this tent as follows:—$3\frac{1}{2}$ oz. cyanide, $5\frac{1}{2}$ fluid oz. sulphuric acid, and $8\frac{1}{2}$ oz. water, and in each case the tent was allowed to remain on the tree 45 minutes. I was using for this purpose commercial cyanide (which is not so good as the pure, or 98 per cent., and, with this, killed over 90 per cent. of the scale.

The trees experimented upon in Mr. McMahon's orchard were Seville oranges, and were in as bad a state as it was possible to be in, and the work done gave every satisfaction, destroying nearly all the scale on the leaves as well as that on the fruit.

With cyanide at 1s. 4d. per pound, and I feel sure we can get all we require at that price by taking a quantity, and sulphuric acid at 2d. per pound, the abovementioned trees cost respectively:—

1st tree ...	... 6 oz. cyanide	6d.	8d.
	$8\frac{3}{4}$ oz. sulphuric acid ...	$1\frac{1}{8}$d.	
	Work	$\frac{7}{8}$d.	
2nd tree ...	... $3\frac{1}{2}$ oz. cyanide	$3\frac{1}{2}$d.	$5\frac{1}{24}$d.
	$5\frac{1}{2}$ oz. sulphuric acid ...	$\frac{3}{4}$d.	
	Work	$\frac{7}{8}$d.	

I quote these two trees as being fully up to the average, and, therefore, base my calculations of cost accordingly. Allowing that these trees would require one spraying each year, as well as the one fumigation, this would increase the cost of each respectively to 9d. and 6d.

If each of these trees were to receive six sprayings a year the cost would be, for the larger tree, sevenpence, and sixpence for the smaller; by which it will be seen that fumigating the larger tree (with one spraying) costs twopence more than for the six sprayings. In the case of the smaller tree there is only a fraction of difference. I would, therefore, give the preference to fumigation because the trees are not in any way damaged by the fumes unless, maybe, in the case of a few of the tender leaves, while the solution used in the sprays must to a certain extent close the pores of the tree and slightly weaken it.

From the experiments carried out and from information which I have been enabled to gather from California and other centres where fumigation has been carried on extensively, I feel sure that it will not

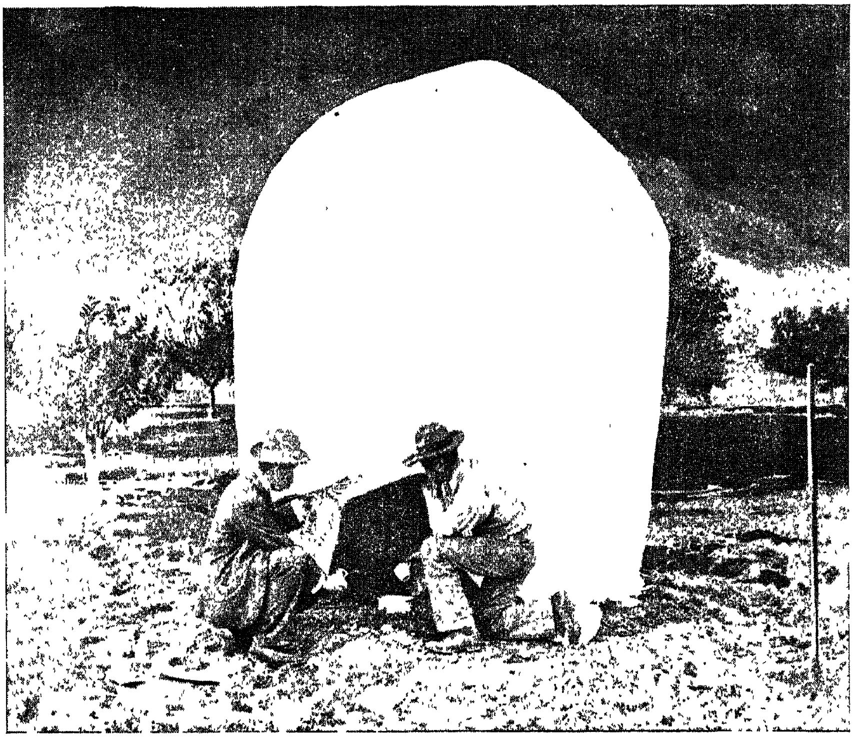


Fig. 2.—Charging.

Fig. 3.—Showing how the tree is completely enveloped during fumigation.

be long before this process will come into general use in New South Wales for the destruction of scale insects on citrus and other trees, where they are very troublesome.

The following list of prices for the different sized tents may be of interest to growers:—

	£	s.	d.
50 x 50 octagon, Clothes best duck	14	0	0
41 x 41 ,, ,, ...	10	10	0
Bell shape covers 9 ft. high 20 ft. circumference	2	10	0
,, ,, 13 ,, 25 ,, ,, ...	3	10	0
,, ,, 15 ,, 30 ,, ,, ...	4	10	0
,, ,, 16 ,, 34 ,, ,, ...	5	10	0

In California, as I have already said, great attention has been paid to this mode of destroying scale insects, and the following extracts from a special report by Mr. C. W. Woodworth, the State Entomologist of California, will therefore be instructive:—

Speaking about the quantity of cyanide best calculated to destroy the insects without injuring the trees or entailing unnecessary expense, Mr. Woodworth says:—"Of fundamental importance is the quantity of chemicals to be used. This has been a matter of considerable variation, and several tables, notably those of Mr. Morse and of Mr. Coquillett, have appeared. The latest table that has been published is that calculated by Professor Johnson, of the Maryland Station, based on his work on the San José scale. It is as follows:—

Height of Tree.	Diameter.	Cyanide.	Acid.	Water.
Feet.	Feet.	Grams.	Ounces.	Ounces.
4	3	6·17	·32	·48
5	4	12·82	·67	1
6	4	18·85	1	1·05
7	4	26·75	1·41	2·11
		Ounces.		
7	5	1·11	1·66	2·49
8	4	1·30	1·95	2·92
8	5	1·50	2·25	3·39
9	5	1·96	1·94	4·41
9	6	2·24	2·36	5
10	7	3·20	4·08	7·02
10	8	3·62	5·43	8·14
11	7	3·95	5·92	8·88
11	8	4·40	6·60	9·90
12	9	5·88	8·82	13·23
12	10	6·51	9·76	14·65
13	9	6·93	10·39	15·58
13	10	7·65	11·47	17·26
14	11	9·76	14·64	21·96
14	12	10·65	15·97	23·45
15	11	13·28	16·42	29·88
15	12	14·24	21·36	32·04
16	14	16·34	24·51	36·76
16	15	17·53	26·27	39·43
17	14	18·39	27·57	41·35
17	15	19·36	29·40	44·23
18	15	22·06	33·09	49·63
19	16	26·10	39·15	58·72
20	16	29	43·05	65·25

Fumigating Outfit.

Common duck is now uniformly employed for making the tent, most of them being made of the 8-ounce canvas, such as is used for light sails. The cloth is lapped and double-sewed in the same manner as for tents or sails. The edge is usually simply hemmed, but some bind it with rope. Whenever permanent rings for handling are attached, the tent is reinforced, but this is a matter in which there is much diversity. The details of the construction will depend somewhat on the size and kind of tent, and will be referred to again below.

After the tent is made, it is treated in some manner to make it gas-tight, so as to confine the gas better. Three methods are used for this purpose, all of which seem to give good satisfaction.

The first method is to thoroughly treat the tent with boiled linseed oil. It is applied freely with a brush, and the whole cloth becomes saturated with it. The tent must be kept spread out till quite dry, for the oil has a great tendency to heat if not exposed freely to the air, and the cloth chars and becomes rotten. If properly done, the tent remains strong and tight, and is not too stiff.

The second method consists in the use of sizing and paint. The sizing is applied in the same manner as the oil, and penetrates the fibre of the cloth in the same way. As soon as this coat is dry it is followed by another of rather thin flexible paint, sometimes on both sides; the result being a perfectly tight tent with a very smooth surface and fully as flexible as the oiled tent. The sizing protects the fibre of the cloth, so there is no danger of heating.

The third method is the saturation of the cloth by a decoction of the chopped-up leaves of the common prickly-pear cactus (*Opuntia engelmani**). This-decoction is made by filling a barrel two-thirds full of the chopped stems, adding cold water till the barrel is nearly full; then letting it soak twenty-four hours, when it is drawn off and strained, and is ready for use. This decoction is seldom used by itself, but other substances are added according to the whim of the person treating the tents. Very generally a pigment, like yellow ochre or Venetian red, is added to give more body to the mixture; sometimes glue is added also. There is some tendency in tents treated with the cactus decoction to become mouldy when not in use, to prevent which some prepare a tannin solution to add to the mixture. The decoction may be applied to the tents with a brush, but a better way is to soak them during the night in a trough containing the mixture. In the morning they can be raised by means of ropes and pulleys and allowed to drain for some time and then spread out to dry. Tents treated with this mixture are scarcely at all stiffened and seem to be satisfactorily tight.

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*It is probable that any of the common prickly-pears would do. They are all illustrated in the *Agricultural Gazette*, vol. ix, part 9.

The Hoop-tent.

The form most used in this State (California) is the hoop-tent, which is a development from the bell-tent, and is of the same general shape. The hoop was first used as a means of keeping the mouth of the bell-tent open, but it was soon discarded in favour of the trail boards. It was, however, discovered that for rather small-sized tents the hoop afforded a better means of handling than did the derrick.

The hoop-tents now in use range from 8 to 14 feet in diameter. They are made in the same way as a bell-tent, omitting, however, the arrangements for suspending them, and possessing instead a series of cloth loops for attaching the hoop.

The hoop is usually made of $\frac{3}{4}$ inch gas-pipe; $\frac{1}{2}$ inch pipe will do for the smaller sizes, but it is too weak for hoops above 10 feet in diameter, as it bends too easily and soon becomes very crooked. To make the hoop, pipe is coupled together until the proper length is reached according to the size desired, and then bent into shape. The union is then made by inserting into the ends a piece of iron rod 1 foot or less in length, and just small enough to enter the pipe. Holes are now drilled through the pipe and rod, and rivets are inserted, thus making the joint fast. A coupling with right and left hand threads might be used instead of the rod and rivets.

Procedure.

The cost of fumigation, and therefore the profit in its use, depends in a great measure upon the arrangement of details, especially in the economical use of time. This is more important than in the case of most methods for killing insects, because of the time—40 minutes—required for the operation of the gas. Fumigation may be economically done in one of two ways; with a small outfit arranged to fit in with other work, or with a large number of tents sufficient to keep all hands busy.

Work with a small outfit can be arranged so as to waste but little time. Fortunately, the tent may even be left on all night without danger, if desired, so that a strict record of the time is not necessary, only that it be not too short. A good arrangement is as follows:—The tents are placed on at the close of the day's work; they are changed after supper, and again just before bed-time, leaving them on till morning, care being taken to pull them off before the sun gets at them. This will give three fumigations each night.

Large outfits are so expensive that the owner generally feels like keeping them in operation all night, though some are used only in the evening. The number of tents necessary will depend on the size of the tent and the number of the men. The smallest number of men that can work to advantage is two; they could handle perhaps twenty tents of medium size. This would allow 2 minutes for each tent, which ought to be sufficient to change the tent and introduce the chemicals. It is

doubtful, however, if the fumigator should take part in the vigorous physical work of changing the tents where so much depends on his judgment.

The number generally employed in a fumigating gang is four or five, according to the size of the trees. One man introduces the chemicals, another looks out for the generator and measures the acid, and two or three handle the tents. Such a gang can handle from thirty to forty medium-sized tents, and cover 4 to 6 acres of orchard in a night.

Estimating the Dose.—The responsibility in the whole process rests on the fumigator, for he is the one who chooses the quantity of the dose; in practice the amount prescribed depends upon his personal judgment. The fumigator looks at a tree and says 8 ounces, 6½ ounces, or 10 ounces, according to his idea of its size. The result is that a great deal of unsatisfactory work is done. The wonder is that the results are as uniform as they are. There are two ways of verifying one's judgment as to the proper doses to be given. The one most commonly used is a subsequent inspection of the trees; the practice being to give a little more gas than the trees will stand without injury. If the slight injury produced is the same on all the trees, the fumigator's judgment is supposed to be working normally. This is very misleading, for the larger the tree the greater the injury, if the dose is properly proportional to the cubic content. The reason for this is the difference in the generation of the gas in large quantities, and its relatively slower diffusion in a large volume.

The other method is to measure the tree and find the amount of the dose by consulting the tables. If the tables are correctly calculated and the measurement accurately done, this is a safe method, but there are grave difficulties in the way of accurately measuring a tree. If not tented, it is difficult to judge how much to allow for the bending of the branches under the weight of the tent. If tented, which is really the correct way, there are practical difficulties in measuring the diameter and height. To simplify the measurement and estimation of a tent, the following table is prepared. The centre column gives the various doses corresponding to the sizes of trees given in the columns on either side. Those on one side have been calculated so as to give three parts of hydrocyanic acid gas in 1,000 parts of air (or 0·3 per cent.), on the other side two parts in 1,000 of air (or 0·2 per cent.). For winter treatment for deciduous trees 0·3 per cent. gas is suggested, and is nearly the strength recommended in the Eastern States for the San José scale. One-half of this amount is not far from the commonest practice in this State for the citrus-trees. The 0·2 per cent. gas is suggested for citrus-trees, and agrees with the amounts used by some of the most successful fumigators, though others get fair results with scarcely more than half this amount.

The measurements to be taken when using this table are (1) around the tent, and (2) over the tent from ground to ground. If these two measurements are about equal, as they will be for many orange-trees, the number nearest the measurement is found in the circumference column, and the corresponding dose will be seen in the centre column.

TABLE showing doses suitable for trees of different measurements.

0·3 per cent. Gas.		Cyanide.	0·2 per cent. Gas.	
½ ounce Differential.	Circumference of Tree.		Circumference of Tree.	½ ounce Differential.
ft. in.	ft. in.	ounces.	ft. in.	ft. in.
3 5	19 1	2	22 1	3 11
3 0	20 6	2½	23 7	3 4
2 7	21 11	3	25 0	2 11
2 4	23 0	3½	26 4	2 8
2 2	24 1	4	27 7	2 6
1 11	25 1	4½	28 9	2 4
1 10	26 0	5	29 10	2 2
1 9	26 10	5½	30 9	2 0
1 8	27 8	6	31 8	1 10
1 7	28 5	6½	32 7	1 9
1 6	29 1	7	33 4	1 8
1 5	29 9	7½	34 0	1 7
1 4	30 4	8	34 8	1 6
1 3	31 6	9	36 1	1 5
1 2	32 7	10	37 5	1 4
1 1	33 8	11	38 7	1 3
1 0	34 8	12	39 10	1 2
0 11	35 7	13	40 11	1 1
0 10	36 6	14	41 11	1 1
0 10	37 5	15	42 10	1 0
0 9	38 3	16	43 9	0 11
0 9	39 0	17	44 8	0 11
0 8	39 9	18	45 7	0 10
0 8	40 5	19	46 5	0 10
0 7	41 2	20	47 3	0 10
0 7	42 8	22	48 9	0 9
0 7	43 11	24	50 2	0 9
0 6	45 0	26	51 6	0 8
0 6	46 1	28	52 8	0 8
0 6	47 2	30	54 0	0 7
0 5	48 2	32	55 3	0 7

If these two measurements are not nearly the same, the outside columns become of use, for they show for each size how much difference must occur to make necessary a half-ounce increase or decrease in the dose. That is, for each differential there must be added or deducted one-half ounce of cyanide. For instance, if the difference between the distance over and around the tree is 5 feet, and the differential for that circumference is 3 feet 11 inches, then the dose must be increased or diminished by a little more than one-half ounce; but if that differential be 1 foot, then for each foot there must be added or subtracted one-half ounce, or 2½ ounces for the 5 feet.

As an example, suppose a tree were 35 feet around and 36 feet over the top, and a person were using the 0·2 per cent. table: Running down the circumference column we find that 34 feet 8 inches (the nearest to 35 feet) requires 8 ounces, and that the differential is 1 foot 6 inches—that is, 35 feet requires a little over 8 ounces, and the difference between the two measurements around and over the tree, 1 foot, is nearly enough to require another half-ounce, so that 8½ ounces would be about right. Suppose, again, the distance around a tree to be 40 feet, and that over the top only 35 feet; using the same

table, we find opposite 39 feet 10 inches (the nearest to 40 feet) the dose 12 ounces. But the distance over the top is 5 feet less, and a less amount of cyanide will be necessary. We therefore use the differential (1 foot 2 inches), and deduct one-half ounce for each 1 foot 2 inches difference, or about 2 ounces altogether. This leaves 10 ounces as the correct dose for this tree.

These measurements are not supposed to be taken with every tree, but in cases of doubt, and occasionally to correct one's judgment; and in the case of those beginning to fumigate, whose judgment is not yet developed.

Estimating the size of the tree is usually done by one of three plans. Some persons plot the orchard in the day-time, indicating the dose for each tree, and fumigating at night in accordance with this prearranged plan. They claim, with some show of truth, that they are better acquainted with the trees by daylight and can more accurately estimate their size. Others do this at night, a row at a time, maintaining that, with practice, it can be done with as much accuracy as when done in the day-time, and that the danger of mistaking the rows is lessened. The third plan, which seems the most rapid and accurate, is to make the estimate after the tent is on the tree. The weighing of the cyanide is done at night, as a rule, but those working by the third plan generally have it weighed in the day-time.

When the weighing is to be done at night, a base of supplies is established as near the centre of the field as possible, and the cyanide and acid, as well as the water, are dispensed at that point, the generators being carried there on trays. A generator tray is a frame holding four generators in a row, or eight if stacked two deep; a person can carry two trays, or generators enough for sixteen tents. After the chemicals are ready, the "fumigator" takes up his tray of cyanide, and the helper two trays of generators, and they proceed to tent after tent, leaving and charging a generator at each tent. When half-way along the row, the helper drops a tray that has been emptied; when he reaches the other end, both trays are empty. The generators are arranged on the trays, as are also the doses of cyanide on the fumigator's tray, in the order of the trees. The next work for the fumigator is to estimate another row of trees, and while he is doing this the helper gathers up the generators of the previous row. They soon both arrive at the base of supplies and proceed to measure and weigh the chemicals for a row on the other side. The details of the third method have already been described.

When the weighing is done in the day-time the average dose is commonly weighed into each can or bag, and a little added or subtracted from the dose as the size of the tree may indicate. When the trees are very uniform, the dose thus varying but little, this may do very well; but if the variation is greater, it will be well to have different-sized doses weighed out. When this is done the can or bag should indicate clearly the amount of its contents by its different shape or character. This method seems distinctly preferable to night-weighing.

Charging.—The generator now universally used is the ordinary earthenware vessel or chamber, the cheap yellow ware being generally

selected. Some use a perforated sheet-lead cover, but generally no cover is used. The fumigator places the generator on the ground near the trunk of the tree and is then ready to charge it, which he accomplishes by dropping the cyanide into the diluted acid in the generator. He has the cyanide either in tin cans or in small paper-bags; in the former case he pours the cyanide into the acid, keeping the can, which he replaces in his tray, but in the latter case breaks the bag and drops it into the acid, bag and all. Some fumigators prefer to add the acid last, in which case the helper brings the generator with only water in it, and keeps the acid in a small pitcher, one for each generator. In this case the fumigator puts the cyanide in the generator, as before, and then pours in the acid.

Poisonous Nature of the Gas.—All the work of the fumigator under the tent is done at arm's length. There is no poison more dangerous or fatal than hydrocyanic acid. The danger from the gas is greatest as it is coming up from the generator. This is so well understood that though the gas has been used for years by a great many people, we have never heard of an accident with it. There seems to be no injurious effect from breathing the diluted gas that fills the air when the tents are removed, even though it may smell very strong, and one can feel it very plainly in his throat and chest. Working every night, for months at a time, does not develop any abnormal symptoms, so it can be safely said that, with proper care, there is no particular danger in the use of the gas.

Inspection.—Wherever fumigation is carefully done the tents will be thoroughly inspected every day. To do this the inspector goes beneath the tent as it lies on the ground, and any holes will be at once seen by the light streaming through; these places are marked and patches applied. Sometimes the patch is glued on, but the usual and preferable way is to sew it on. Sewing is done by hand in the same way as sails are mended, or sometimes a sewing-machine is used.

In the illustrations accompanying this article, the method of fumigating trees at the Hawkesbury Agricultural College orchard is depicted. Fig. 1 shows how the tent is placed over the tree; fig. 2, shows everything in readiness for charging; and fig. 3, the way in which the tree is completely enveloped.

Dairy Bacteriology.

M. A. O'CALLAGHAN.

The Preservation of Dairy Products.

Pasteurisation and Sterilisation.

WHEN delivering lectures on the pasteurising of milk and cream, I am often asked the question—How is it that in the good old days, when every man made his own butter, microbes and pasteurisation were never heard of? And how is it that people managed to make good butter at that time without any of these new-fangled ideas? The answer is, that the heavy salt butter made then was in keeping with the times, and quite up to the demands of the then public taste. Later on, however, others—the French and Danes—produced an article which the public palate preferred, and the heavily-salted coarse article of commerce disappeared before the finer-flavoured and milder product of more modern days, and the separator ousted the milk-pan and the swartz-can from our dairies. They thus pleased the public, and educated their tastes to an article of a much milder and finer flavour; and it remained for other countries either to adopt similar machinery and similar measures or lose the trade, and abandon dairying altogether. The consumer now received an article which was very nice to taste as long as it was quite fresh; but he found that, in the absence of the large percentage of salt previously used, the butter would not remain sweet long on his table, and he suffered loss by a part of every purchase having ultimately to find its way to the kitchen for cooking purposes. The merchant also found that when there was a flat market, and he was unable to clear all his stock, he suffered financially by said stock deteriorating considerably in quality, and hence in value, before the next week's market. In fact, many merchants always adopted the course of accepting any price in reason for creamery butter whenever the market was dull, knowing full well that it was wiser to clear all, even at a half-penny per lb. under top rates, than get a good price for some, and be compelled to hold the remainder over till next week, and suffer a loss of a penny to a penny half-penny per lb on it.

Another step was now taken in the path of the industry, and preservatives other than common salt were called in to prevent the loss, through rapid deterioration, on the part of the merchant and the householder. These filled, and do still, a very treacherous hole in the path, but analysts began to make known the fact that this butter of modern taste contained substances which medical men declared to be injurious when taken in undue quantities, and another way out of the difficulty was sought by men of intellect and thought. Storch taught

the Danes what Pasteur had years previously taught the scientific world—that decomposition and decay were due to the presence of very minute living objects; and that these microscopic organisms could be destroyed by means of heat. However, another step yet remained to be made, for it was found that cream would not ripen without the aid of some of these organisms, and it became necessary to discover which species brought about the desired ripening, and then, after all had previously been killed or severely wounded by means of heat, to add this desirable species in sufficient numbers to overrun the few noxious ones that remained undestroyed, or that obtained access by adventure later on. This was done, and, together with efficient refrigeration, a chain was forged which firmly binds the public taste of to-day, and if we are to arrive at the highest point of possible success, we shall have to forge a pattern of that chain. To go back again to the question of the sceptical inquirer who wishes to know why it is that when he was a youth he never heard the words "microbe" and "pasteurisation," we might reply that he also never heard of the telephone and phonograph at that period; also, that his ancestors never received a telegraphic message, and never rode in an electric train or motor. He believes these things, however, because he can see them, although he cannot see or perhaps understand the force that is at work to bring them about. If he came into our laboratory for a week, also, he would no doubt believe in the work that microbes are capable of doing, because he would see the changes taking place in the medium in which they were growing and working. His doubt, however, seems not unexpected when we bear in mind that at as recent a date as 1876 the celebrated and deeply-regretted Louis Pasteur, to whose genius the world will never be able to calculate what it owes, was fighting the cause of light and truth on this subject with many of the ablest scientists of his time. Pasteur it was that clearly proved to a doubting, a critical, and obstinate world that decomposition could not take place in organic substances such as milk, meat, eggs, &c., without the presence of these minute forms of life (micro-organisms). On 8th October, 1871, he heated a number of bottles of beer to 131 deg. F., and on 27th July, 1872, compared the beer in these bottles with that in a number of bottles of the same beer that had not been heated. "The beer which had been heated was remarkably sound and well flavoured. The beer which had not been heated had undergone changes which made it quite undrinkable.* The deposits in the heated bottles showed filaments of disease, but in such minute quantity that it was necessary to search many fields of the microscope to discover their existence. Those which we found after the heating must have existed in the beer before that operation, the heat had destroyed them without sensibly altering their size or shape. They could neither multiply nor continue to exert any influence upon the components of the beer." The heat had evidently destroyed the organisms which caused the disease in the unheated beer, but it had not killed the organisms which caused alcoholic fermentation. This was Pasteur's deduction. It proved to

* Pasteur's Studies on Fermentation, by Faulkner and Robb.

be correct, and paved the way to new processes in brewing. It also pointed the way to our present subject—the pasteurisation and sterilisation of milk. Another paragraph from Pasteur's "Etudes sur la Bière" should interest bacteriological students and dairy workers of to-day:—"Very often the whole work of the brewer is jeopardised by the unsuspected presence of diseased ferments, a remedy for which is only devised after the evil has evoked the complaints of customers. In such a case, the brewer avails himself of the kindness of some other brewer to obtain a change of yeast. The brewer whose produce is most satisfactory recognises the fact that unforeseen circumstances may compel him at any time to change his yeast." Hence all brewers obliged one another. Pasteur further on recounts, as an illustration, an incident which occurred when he, in 1871, was seeing over a large London brewery, where he was permitted to examine the various yeasts used for bringing about fermentation. He found the porter yeast impure, it abounding in organisms of disease, and, on inquiry, he learned that the working of the porter had been unsatisfactory for a long time. A lot of other beers were examined, and Pasteur found disease ferments present, of which he writes as follows:—"We asserted in the presence of the head brewer, who had been summoned, that these ales were extremely liable to change, that it was highly necessary to dispose of them without delay, and that they were necessarily already faulty in flavour—a fact which was admitted by the brewer after some hesitation." How accurately this description of these ales would fit a great deal of our "local consumption" butter made in Australia at present. It is not bad if eaten soon after it is made, but if held for any time it becomes only fit for pastry. The cause is the same also, viz., a mixed or foreign fermentation, due to the presence of injurious micro-organisms in the milk. The cure must also be the same, viz., some means of bringing about a change of fermentation. We must use a means of destroying the injurious ferments, and of then introducing the desirable kind. Thus, briefly, are some of the facts bearing on the history of what is now known as pasteurisation, a word coined to do honour to the universally famous *savant*, the late M. Pasteur. It is seen that there were, even among scientific men, many who doubted Pasteur's theory of fermentation as late as twenty years ago. This will show how young is the science of bacteriology, how much must remain to be discovered, and how it is that its application to dairying could not have existed at the time when many of our present dairy-farmers were in their youth. Let us hope that, like the telephone, they will make full use of it, even though it has come late in their lives.

It is thus seen that pasteurisation might be defined as the application of heat to liquids for the purpose of destroying or checking the growth of undesirable micro-organisms therein. It is to the dairy manager what the plough and scarifier are to the farmer. It prepares the soil (cream) for the reception of the seed (lactic ferment), and if the soil be well cleaned, and the seed be good, the harvest should, with fair conditions, be abundant and of good quality. On the other hand, if we only half clean the soil, and the district is favourable to the

growth of weeds, the crop is certain to be an indifferent one, even though the seed be the best, for the weeds will fight the cultivated plants for food and for supremacy, and the result will be a half-nourished, half-choked crop, whose seed will in turn be impossible to harvest without getting contaminated with the seeds of the weeds, thus guaranteeing, unless we have a change of seed, an unhealthy harvest for the coming year. Also, though we may cultivate and clean the land thoroughly, our work will be spoiled unless we procure pure and healthy seed to sow therein, for there is little use in cleansing the land if we reintroduce weeds with the seed. The latter will propagate and thrive all the more freely on the good and well-cultivated land, and if the proportion of cultivated plant-seed to weed-seeds is not very great, the probability of getting a satisfactory yield will be very small. (Those who use lactic ferment will do well to bear this fact in mind, and to make sure that the seed they thus sow is pure and unadulterated.) Now, it must be understood that, while the pasteuriser is a good cultivator for the dairy worker to use, it does not follow that the fact of having a pasteurising machine in a factory ensures good butter any more than the finding of a good plough, harrow, and scarifier on a farm is a guarantee that the land has been well tilled, or that the crop will be a sound and heavy one. These things are only evidences that the necessary tools are there for doing good work. Other things are required, viz., fair soil, a good farmer, and good, pure seed. The pasteurising machine, the separator, the churn, and the refrigerator show that the factory manager possesses the tools necessary to the manufacture of first-class butter; but there is wanted, in addition, a man who knows how to and who makes proper use of these instruments. He will also want fair soil, in the shape of suitable milk or cream, and he will want pure and vigorous seed, in the shape of a ferment containing only the germs of lactic acid or good flavour-producing plants, and this must not be enfeebled by age or other injurious conditions. The pasteuriser is, therefore, a modern tool, recently introduced to Australian dairymen for the better preparation of their milk and cream for butter-making. This tool, it must be remembered, has for some years been adopted by our competitors in other countries, and with much success. Let us now see the proper place for this machine in dairy work. Every farmer knows that it is not absolutely necessary for the production of a good crop to kill every weed and weed-seed in the cultivation plots, but that the more of them we destroy and the less we leave behind the better will be our crop. Now, as I have in previous articles demonstrated, the particles of dust and dirt which are constantly being blown about are laden with the seeds of micro-organisms, many of which are capable of setting up injurious fermentations in milk, cream, and butter, and it is impossible in ordinary practice to prevent these from getting into the milk, just as it is impossible for the farmer to prevent the seeds of weeds being carried on to his lands by winds and birds. If we keep our own lands pretty clean, however, and that our neighbours round about do likewise, the number of weed-seeds getting on and growing on our farm will not be very great. Especially must we avoid the very injurious weeds, and we

should also endeavour to get our neighbours to keep these down, for, if our neighbours' lands are badly affected, the seeds are certain to be brought by some agency to ours. The case of the dairyman and the injurious micro-organisms is exactly similar. He must, by adopting the most scrupulous cleanliness, endeavour to avoid the very detrimental organisms, and he will be aided in his endeavours if his neighbours adopt a similar course. He might say: What is the necessity for this care if the pasteurising machine will destroy all micro-organisms? This is just the point where error creeps in. The pasteurising machine can be made to destroy all micro-organisms; but some are so tenacious of life that it would be impossible to completely destroy them and their spores or seeds in the ordinary working of our machine. We should have to go over the ground again and again in order to do so, and this is impracticable in the working of our factories. Farmers well know that it is possible to get, in this prolific continent, plenty of land so over-run with weeds that it would never pay for the amount of work we should do if we were to rid the soil completely of these weeds in one year's cultivation. It could be done, but the labour would be enormous. Australians are also aware that in clearing some land of its timber the trees are of a kind which produce second growths (suckers) so rapidly that unless we dig them right out, root, branch, and seed, they cannot be got rid of. It is thus with the most injurious micro-organisms. We cut down the growing plant; but from its seed or from its semi-destroyed body another plant quickly springs, and it is only by applying the destroying agent before this new organism has, in its turn, time to produce seed that we can rid our milk entirely of its noxious presence. In pasteurising milk or cream for butter-making we cannot afford to go over the work a second time, and hence these organisms, which are so tough, which produce injurious fermentations, and which are only met with where cleanliness is not observed, should be avoided by all dairymen, whether a pasteuriser is or is not used. Also should these extremely injurious organisms get into the milk at the farm-house the probability is that they will already have tainted the milk before it reaches the factory, and, though the pasteuriser may destroy the organisms, and thus check the mischief, it cannot remedy the amount of mischief that has been already done. It cannot make sour or bitter milk sweet; but it can, if used in time, destroy the causes of, and thus prevent, the sourness and the bitterness. Thus, pasteurisation is applied to milk and cream for the purpose of preventing the butter from becoming at an early age both rancid and bitter.

THE coloured plates show the various forms of growth of yeast I have frequently found in milk and cream, and which is here named *Saccharomyces lactis* (not saccharonyces, as printed on the plate). It would be of injury to butter-makers but still more so to cheese-makers, as the great amount of gas (CO_2) which it forms would cause a spongy curd.

(To be continued.)

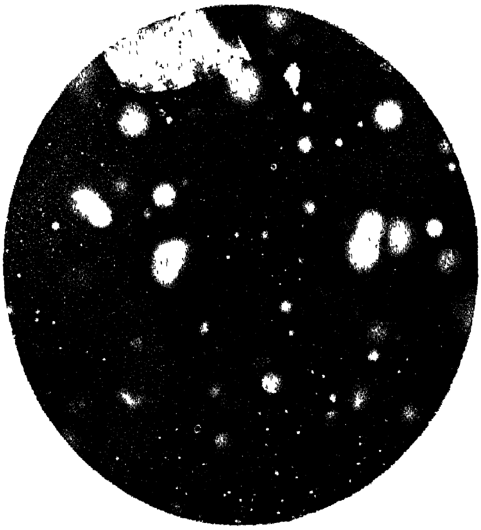


Fig. 12.—Showing injurious micro-organisms in the air of a store-room (p. 822) of a factory.

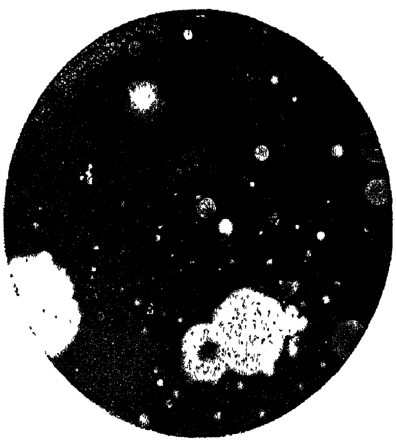
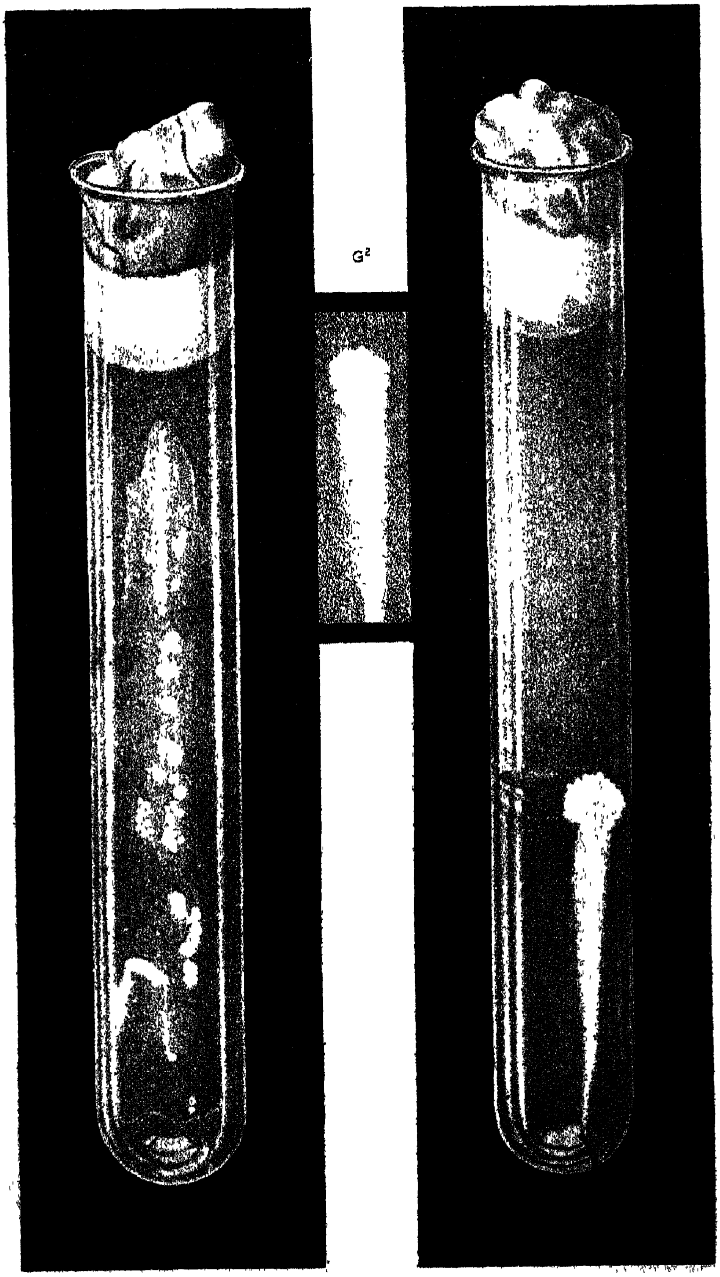


Fig. 13.—Showing injurious micro-organisms in the air of the cream-cooling room of the same factory (p. 822).

DAIRY BACTERIOLOGY.

THESE two illustrations will help to demonstrate to factory-managers how easily their milk and cream might get badly contaminated from the atmosphere in the rooms of the factory, and how necessary it is that even when they pasteurise their cream that they also take care to keep their factories regularly cleansed. No. 12 shows up the number and variety of micro-organisms in the air of a store-room of a well-known factory. There are fifteen varieties of organisms (six of which are moulds) present, seven of which are injurious to milk, cream, and butter. Illustration No. 13 is from a determination of the micro-organisms knocking about in the atmosphere of the cream-cooling room of same factory. Most of the same organisms are present in this that were present in the air of the store-room on the upper floor, besides some others of an unfriendly character. The cream-room was constantly cleansed, but still infection was constantly occurring, and this was traced to the store-room. This will illustrate how necessary it is to keep all the rooms and surroundings of a factory constantly cleansed if dairy products of the highest order are to be produced.



MICRO-ORGANISMS IN MILK.

These illustrations show the growth of a yeast—saccharonyces lactis—which I have frequently found in cream. It coagulates milk very slowly, and forms alcohol and carbonic acid gas (CO_2), imparting a sharp bitter taste to cream and milk. It is an injurious micro-organism to butter-makers.

G *shows a streak culture of this micro-organism on agar. The colonies are white, but not glistening.*
G1 *shows a stab culture of the yeast in gelatine, where it is seen that a luxuriant growth takes place along the track of the needle.*
G2 *illustrates the peculiar nail-like growth on the surface of gelatine, with serrated edges.*

Bee Calendar.

ALBERT GALE.

August.

"March winds and April showers bring forth May flowers" is an old English proverb, and peculiarly applicable to bee-keeping. So far we have had plenty of rain and other conditions conducive of an early spring and plenteous harvest of blossom. Apiarists should take every precaution to be in readiness for the work of the season. Commence with a thorough examination of the hives and contents whenever the weather is nice and bright. If food on hand does not appear to be plentiful, feed rather sparingly. Shift the dummy or division board as required, so as to give a fair amount of room for the young brood. Do not allow too much room, but just sufficient for the bees to conveniently utilise. Excessive space at this season requires a lot of heat to hatch out the brood. Drones will be necessary; indeed, in the warmer parts of the colony numbers of young bees were on the wing with a fair proportion of drones amongst them. If your brood-combs have been worked on full sheets of foundation, it is possible you may be short of drone-comb. In that case it is just as well to put in some empty drone-comb, and place a frame of worker-brood on either side of it. By no means separate it from the main body of bees. If you have one or more weak colonies, unite them; it is much better to do so at this season of the year than to try to build them up. Where the season is favourable commence queen-raising. In the warmer districts, in large apiaries, this has been going on for some weeks. In examining the comb see that the pollen or bee-bread has not turned mouldy. If there is plenty of new pollen coming in, it will be as well to remove the greater part of that left over from last season. There is a proverb in the west of the Old Land that runs, "A swarm of bees in May is worth a load of hay; a swarm of bees in June is not much out of tune; but a swarm of bees in July is not worth a single fly." Early spring swarms are the profitable ones; and if your stocks have been kept fairly strong through the winter, early spring swarms will be your rewards and will do much to make your bee-keeping a grand success.

Farm Notes.

NORTHERN RIVERS.—August.

H. V. JACKSON.

If the weather is showery, get on with the sowing of *Paspalum dilatatum.* Use not less than 5 lb. of seed to the acre. For sowing, mix the 5 lb. of seed through about 25 lb. of sawdust. After broadcasting this mixed seed and sawdust, go over the ground with a bush harrow.

Natal Red-top (*Tricholæna rosea*) should also be sown either alone or as a mixture with other grass-seeds, likewise Guinea-grass (*Panicum maximum*). In localities free from frost, the Guinea-grass will be found most useful for green fodder. Guinea-grass and Red-top together have been found to make excellent hay; the Guinea-grass should not be allowed to grow too tall and rank for this purpose. Make a good sowing of potatoes in ground well prepared and manured. See that the seed is sound, and that the eyes are well sprouted.

If any small tubers of sweet potatoes are available, plant them now. Arrowroot, yams, and tapioca may be planted. Arrowroot and yams are grown from the tubers—tapioca is propagated from cuttings. Yams, sweet potatoes, arrowroot, and tapioca are all useful for making pig-food, apart from their value in other respects; they should always be cooked by boiling or steaming before serving up as food. Jerusalem artichokes may still be sown. Sow French beans; carefully steep the seeds, and sow them in damp soil, so that they get a good start.

Cucumbers, rock-melons, water-melons, marrows, and squashes may be sown; also sow peas, pumpkins, and tomatoes. Plant out potato and tree onions. Sow mangold and sugar-beet, also chicory. Barley may still be sown, also rye. Oats may be sown for greenstuff.

Sow cow-peas for green manuring and for seed. They are valuable as a soil improver, as they furnish nitrogen and aid the formation of humus. They may be sown broadcast, or in drills 2 feet or 3 feet apart. The most commonly used is the large black cow-pea. There is a pretty good demand for the seed, and it is always advisable to harvest some if not all of it, and then plough the vines into the ground. They may be sown on any or all land immediately after harvesting crops.

A small quantity of different varieties of cow-peas were sown at the Wollongbar Farm, in January, 1899, and are reported on as follows:—

Whip-poor-Will.—This variety produced a very luxuriant growth of leaf and vine, reaching an average height of between 2 feet and

2 feet 6 inches, the growth being somewhat more erect, *i.e.*, it did not appear to creep so much as the others. The size of the pods, and also the peas, was much the same as that of the ordinary black pea. The colour of the foliage was a dark velvety green. The quantity of seed was equal to 258 lb. per acre. The seed was gathered the first week in May.

Black cow-pea made very good growth, and took second place. Size of pods was much the same as other varieties, but the peas were larger. This black variety made a more rapid growth than any, and the seed matured fully a week earlier than others. Quantity of seed from one picking was equal to 312 lb. per acre. The seed was gathered about 20th April, 1899.

Clay-coloured.—The growth of green fodder was not quite so heavy as the varieties already mentioned. The pods were the largest of any. The size of the peas were about the same as the black variety. Quantity of seed from one picking was equal to 468 lb. per acre. Gathered 28th April, 1899.

White Cow-pea.—The growth of green fodder was similar to the clay-coloured, being not quite so heavy as other varieties. The pods were similar in size to the black and Whip-poor-Will, but the peas were the smallest produced. Quantity of seed per acre from one picking was 156 lb. Gathered 28th April, 1899.

The yield of seed in all the varieties would have been much larger if two or three pickings had been obtainable. Some heavy rain fell previous to the first picking, and a considerable amount of seed was lost in consequence, and after the first picking further rain fell and spoiled the balance. There is a fairly good demand for seed of cow-peas true to name, and it is just as well, if growing seed for market, to only grow one variety. Sow sun-flower, amber cane, Planter's Friend, and millet. Plant out strong tomato seedlings; also plant chokos—they are best grown on a trellis or summer-house.

Put in maize for grain crop and green fodder. In the season previous to the one just passed, a number of varieties of maize were grown, the following being some of the estimated yields per acre in bushels :—Hickory King, 17; Yellow Flint, 20; White Meal, 32; Iowa Silver-mine, 36; Thousandfold, 19; Monaghan, 44; Big Yellow, 39; Leaming, 56; Mastodon, 57; Chester County, 35; Pedrick's Golden Beauty, 42; White-cap, 34; Golden Beauty, 44; King of the Earlies, 32; Iowa Gold-mine, 41; Large Hawkesbury, 49; Red Core, 43; Golden King, 55; Conqueror—this variety was the heaviest grain of all, but not sufficient to estimate a yield.

The season just ended was an exceptionally trying one at the farm, and the maize crops were almost a failure. The yields obtained from the varieties sown were as follows, stated in bushels :—Ninety-day, 19; Golden Drop, 12; Sixty-day, 30; Golden King, 23; King of the Earlies, 27; Red-nibbed, 23; Mastodon, 34; White Maize, 36; Hawkesbury, 37; Large Yellow Flint, 22; Leaming and Conqueror were also grown, but, owing to the dry weather, they were pulled and thrashed in the early part of January, as it was not considered they would make a crop, and no record was kept of the yield in consequence.

The varieties Yellow Flint and Sixty-day appeared to be most free from weevils. The Ninety-day was also fairly free from weevils. No manure was used.

Prepare ground for planting bananas, guavas, pine-apples, and passion-vine. If the farm carries bees and poultry, put in a little silver-hulled buckwheat.

It is getting late for planting deciduous fruit-trees, and if the weather has been damp and mild, some trees will be bursting into leaf. Finish pruning as soon as possible, and get all trash and rubbish and cart it away to the compost heap or the fire-heap. After pruning, spray with Bordeaux mixture. Manure the trees with a little kainit or potash manure. Grafting may now be carried on. In the vineyard, the vines will be just about to break into leaf. Powdered sulphur should be dusted freely and frequently about the stems. If this is done early, probably the *oïdium* will be checked.

Horses and cattle occasionally meet with accidents of a more or less serious nature in the shape of flesh-wounds. Ordinary simple cuts heal the most readily; but where the wound is angular or round it frequently takes a long time to get well. Barbed wire, which is so largely used for fencing here, is often the cause of trouble, and I have known wounds caused thereby prove very vexatious, especially if the cut be deep. In such cases it is unwise to attempt to heal the wound too rapidly, as inflammation or ulceration may be going on beneath. It is important to keep wounds clean, by gently syringing with luke-warm water; particles of gravel or dirt or broken stick removed with a proper instrument. The abraded surface should not be rubbed or touched with coarse cloths or other substance when washing. For simple wounds, a little carbolic ointment on cotton wool or tow applied to the part will help to exclude the air and keep away flies. Lint, steeped in Friar's Balsam, is also good. It is little use putting in stitches in fleshy parts—they nearly always break away; therefore, proper dressing and bandaging is best, but the dressing should not be applied until bleeding has ceased and the wound has been washed. In simple cases, the wound may be brought together and held with shellac plaster. It is necessary, in such a case, to remove the hair from about the wound, or the plaster will not hold. Stitching a wound at times is useful in parts where there is little flesh. Bandages should be put on neatly and evenly, and applied from below upwards in such a way as to hold the dressing in place, but not over the dressed wound. The bandages should be firm, but not so tight as to interfere with circulation. When bleeding occurs in excess, if the blood comes in spurts and is of a bright scarlet colour, it is from an artery; if the flow is in a steady stream, and of a dull red colour, it is probably from a vein. When the bleeding occurs in one of the legs, if supposed to be an artery, pressure must be applied above the wound; and if from a vein, then from below the wound. Bandages or other means adopted by pressure to stop bleeding should be loosened so soon as possible when it is considered it may be safely done. The groin, neck, and body parts are the most difficult to deal with in cases of serious severance of blood-vessels. Many temporary expedients are adopted by people on the

spur of the moment, such as applying cobwebs, cotton-wool, &c., in the absence of other means at hand. I have seen powdered alum and flour persistently splashed on the torn part stay somewhat copious bleeding, but they were not *serious* cases.

An inquiry was recently submitted to me regarding noxious weeds and their extermination, especially in regard to *Sida retusa* (Paddy's Lucerne) and *Lantana camara* (Lantana). Notes on noxious weeds will be found in the March, April, and May numbers of the *Agricultural Gazette* for the year 1895, by Mr. J. H. Maiden, F.L.S., the Government Botanist, in which reference is made to the *Sida retusa* and Lantana. The question is asked by a correspondent as to whether these troublesome plants cannot be eradicated by something that would take their place and be useful; but at present I do not know of anything likely to be useful and prove effective in such a way. In Ceylon, I believe, some mention has been made of attempting to substitute the Ramie plant in waste places overrun with Lantana; but nothing has so far been actually done in that direction. Occasionally a beast is discovered suffering apparently from the effects of having eaten some deleterious plant. The indisposition may be from some poison which causes derangement of the intestines and kidneys, or it may be caused through the material eaten bringing about an obstruction internally. The so-called wild peach (*Trema aspera*), of which there is plenty growing hereabout, is considered by many to be poisonous, especially at a certain season of the year. The trouble it causes, however, is probably due to its fibrous nature. "It is said to stop all food passing through bullocks, causing death in a few days" (J. H. Maiden). "The most carefully-made preparations of both the green and dried plant were neither bitter, nor had they any effect upon frogs" (Dr. T. L. Bancroft). There are several objectionable weeds growing in this locality; but there is little or no data in regard to their poisonous action. The Thorn-apple (*Datura stramonium*), sometimes called "Castor-oil Plant" in error, is a weed I always eradicate if possible. We have also *Cassia* species, likewise *Solanum nigrum*—commonly, I believe, called "Black-currant bush," and I have also noticed a plant which I take to be Solanum, pseudo-Capsicum, or False Capsicum, growing wild, of which I am also very suspicious. There are also *Helichrysum* species growing, which, if not poisonous, may cause internal disturbance through the matting together of the hair-like material of the plant. If appearances point to a beast in distress suffering from poison of a narcotic character, inducing an apoplectic or dazed condition, a pint of warm vinegar may prove beneficial. If the kidneys are apparently affected, usual remedies should be applied in the shape of hot fomentations.

RIVERINA DISTRICT—August.

G. M. McKEOWN.

Lucerne

May still be sown. The land should be thoroughly prepared by deep ploughing in the deeper soils. If the subsoil is hard it should be broken by means of a subsoil plough, and where a proper implement is not available an excellent substitute may be prepared by removing the mould-board from an ordinary plough and following with it in the bottom of the furrow made by the mould-board plough, thus breaking the subsoil without bringing any of it to the surface.

Potatoes.

The land should be deeply ploughed where a good depth of soil is available, and brought into a fine condition.

Medium-sized potatoes may be planted whole, the larger tubers being cut into sets, each having two or three eyes, the sets being planted in drills 3 feet apart and 15 inches apart in the drills.

The best varieties in this district are Bliss's Triumph, Early Rose, Ruby, Australian Monarch, and Lord Tennyson. In good seasons Imperator and Brownell's Beauty will give good results.

Green Fodders.

Barley may still be sown for green fodder only.

Prepare land for spring sowing of sorghum, millet, cow-pea, &c.

Vegetable Garden.

Sow onions for pickling and other purposes early in the month.

Peas may still be sown if the weather proves moist.

Sow cabbage—St. John's Day and Early Drumhead being the best summer varieties. Sow in hot-beds for early transplanting, tomatoes and cucumbers.

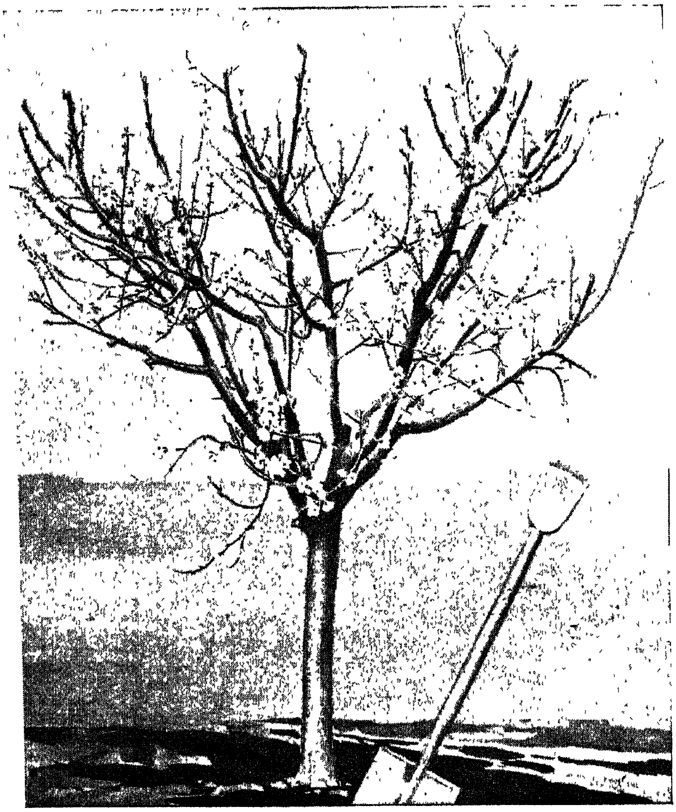


Fig. 1.—A three-year-old peach-tree at Wagga Orchard, showing the even distribution of blossom as the result of systematic pruning.

Fig. 2.—Showing growth made by a three-year-old peach-tree, under good cultivation, at the same orchard during the past dry season.

Orchard Notes.

W. J. ALLEN.

AUGUST.

THIS will be another very busy month for the fruitgrower, and more especially if he has allowed his work to accumulate. Refilling of all deciduous trees and vines must be completed as early in the month as possible. I trust, however, that all this work has been completed at least a month ago, and if so, the roots of the trees will have started to grow before this. If any of the newly-planted trees are not yet cut back, see that this work is done at once, and do not be afraid to cut them to within 18 to 20 inches of the ground, leaving only a straight stock from which you can start the branches properly, distributing them at different points up and around the trunk, so that each one gets a good firm hold by itself.

Citrus refills may be planted at the end of the month in districts where rain is depended on, and where irrigation is not practicable.

As soon as the winter pruning and spraying are completed the orchard should be ploughed immediately (if fall ploughing has not been practised), as turning up the soil tends to sweeten it, and more, it absorbs the spring rains more readily, thus storing up a supply of moisture which is required to keep the trees alive and growing through the hot summer months; and I think every fruitgrower will admit after the experiences of the past few years that our only safe plan is to give cultivation our very best attention if we hope to harvest a good crop of fruit and keep our trees in a healthy growing condition. It has been well demonstrated during the last three dry seasons that we must depend upon ourselves rather than the weather, and those who have kept their land thoroughly cultivated have, in spite of the bad seasons, taken off good paying crops of fruit.

All pruning of deciduous trees should be completed by the 1st of the month, and in orchards where this work is not completed it should be finished with as little delay as possible, as the early part of the month is in many districts quite late enough for the application of the salt, sulphur, and lime spraying, which should immediately follow the pruning. This spray is a good insecticide, as well as being a good fungicide, and every deciduous tree in the orchard should have a winter spraying with it. If this does not kill all the woolly aphis on the apple-trees, they should receive a thorough spraying with hot resin-wash, as should also the peach-trees for black aphis. A good way to keep the peach aphis in check is to inspect the trees twice a week and

cut off all small twigs which are infested and burn them. I have heard of splendid results being obtained in this way—in fact, I have the assurance of one large grower that this is all he did; and he was so well satisfied with the results that he intends following the same course again this year.

All old bark should be scraped from apple and pear trees, and everything destroyed in the orchard which would be a harbour for codlin moth grubs.

In working around the vines keep a sharp lookout for the vine moth pupæ. If there are any old partially-rotted stakes the pupæ will be found adhering to them; also under the old bark which is hanging to the vine. Crush these wherever found, and thus assist in keeping the pest under as much as possible.

For those who have citrus orchards, I would recommend them to give their trees a thorough spraying with special resin-wash before the trees begin to bloom. This wash is, without doubt, the best one for destroying red scale, and if it is used systematically and properly applied with a good spray-pump there need be little, if any, red scale in the orchard.

Fig. No. 1 is the photograph of a three-year-old peach-tree at our Wagga orchard, pruned and showing the blossom all through the centre as well as the outside of the tree.

Fig. No. 2 is that of a three-year-old peach-tree at same orchard, showing the growth which, under good cultivation, the tree made during the past dry season.

It can be seen that the ground is in a state of thorough cultivation, it having received one winter ploughing and about fifteen cultivations during the year.

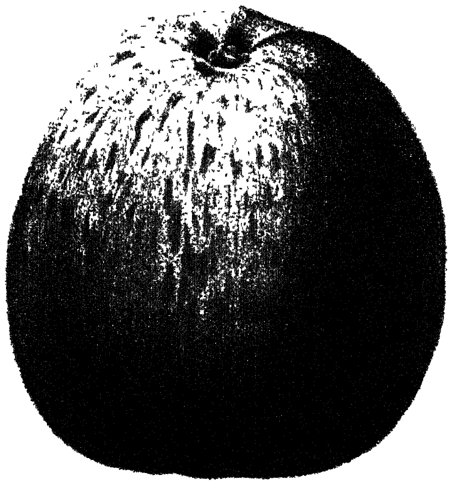
I shall endeavour when space permits to have illustrations from month to month showing some of our best varieties of fruits, with descriptions of same.

As yet I am unable to give a full list of apples which have proved blight-proof in this Colony, and I would be pleased if growers who are readers of this *Gazette* would let me know which varieties in their districts are free, as I wish to publish as complete a list as possible of our best blight-resistant apples for the benefit of growers.

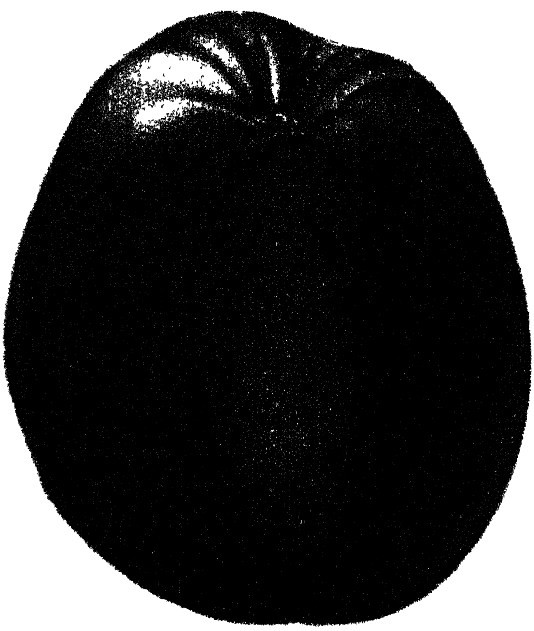
In our various farm orchards we have upwards of 500 varieties of apples which up to the present have shown no signs of the blight, but among these are many which will, I know, take the blight unless every precaution is taken to avoid it.

The two apples shown in the coloured plate this month are:—

Winesap.—According to Downing, and from my personal experience, this is not only a good apple for the table, but it is also one of the very finest cider fruits, and its fruitfulness renders it a great favourite with orchardists. The tree grows rather irregularly and does not form a handsome head, but it bears early and the apples have the good quality of hanging late upon the trees without injury, while the tree thrives



WINESAP.



ESOPUS SPITZENBERG.

well on sandy light soils. The tree is very hardy and one of the most profitable orchard varieties wherever grown. Young wood reddish brown with smooth red buds. Fruit of medium size, rather roundish oblong; skin smooth, of a fine dark red with a few streaks and a little yellow ground appearing on the shady side; stalk nearly an inch long, slender, set in an irregular cavity; calyx small, set in a regular basin with fine plaits; flesh yellow, firm, crisp, with a rich high flavour. Very good. Should make one of our best for export when grown in the colder parts of New South Wales.

Esopus Spitzenberg,* according to the same authority, is a handsome truly delicious apple, and is generally considered by all good judges equal to the Newtown Pippin, and unsurpassed as a dessert fruit by any other variety. It originated at Esopus, a famous apple district, originally settled by the Low Dutch on the Hudson. But throughout the whole of New York it is considered one of the first of apples. The tree has rather slender shoots, and when in bearing has long and hanging limbs. Fruit large, oblong, tapering roundly to the eye; skin smooth, nearly covered with rich, lively red, dotted with distinct yellowish russet dots; on the shaded side is a yellowish ground with streaks and broken stripes of red; stalk rather long (three-fourths of an inch) and slender, projecting beyond the base and inserted in a wide cavity; calyx small and closed, set in a shallow basin which is slightly furrowed; flesh yellow, rather firm, crisp, juicy, with a delicious rich brisk flavour. Best. Seeds in a hollow core. Only suitable for the colder districts of New South Wales.

Simple Treatment for Woolly Blight.

Mr. A. Wilkinson, of Lydford, North Sydney, has forwarded the following particulars of a method he has adopted to keep under the woolly aphis in his orchard on the Hawkesbury River:—"Have a little woolly aphis on trees of American origin, viz., Nickajack, King of Tomkins County, and Jewett's Best. Would soon have trees covered if I did not attend to them weekly. The disease is slight now compared to what it was three or four years ago. I use a small paint brush and dab every speck of blight I can see with a mixture of soap and soda, boiled up to a paste, which I keep by me. I believe the pest must get into my place from a distant ridge, and across a deep gully, where I am told the trees in an orchard are covered and white with it."

* Sometimes written *Æsopus Spitzenburg*, or *Spitzenburgh*.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of August.

Vegetables.

As a rule spring may be said to begin in August, although there are districts on the table-land where very cold weather may still prevail. Elsewhere most of the tender kinds of vegetables may be sown or planted out.

At time of writing these directions, rain has just fallen throughout the Colony, very heavy about the coast, but much lighter inland, giving indications that we may expect a return of favourable seasons, and with the return of good seasons vegetable growing will be practicable again in places where it has been almost impossible to grow anything for the last three or four years. To grow vegetables to perfection it will be necessary to dig well or trench the soil, manure heavily, drain thoroughly, and, if possible, have the garden so situated as to have a good supply of water convenient.

The following vegetables can now be planted or sown:—

Asparagus.—This is a good time to plant in all the warmest portions of the Colony. Planting may be delayed if it is desirable to do so in the cold climates; but wherever the buds or shoots give indications of starting into growth, plant as soon as you can. Some care should be taken in the planting, in spreading out the thick fleshy roots so that they are not all bunched up together. Look through the plants carefully before planting, and cut away all broken roots, as well as all that are torn or bruised. The best way to carry out the planting is to dig trenches a few inches deep, sufficiently broad to allow of the roots being spread out to the fullest extent. To do the work very nicely, the bottom of the shallow trenches should be made higher in the middle than at the sides—say 2 or 3 inches—then the crowns of the roots will stand higher than the extremities of the roots when they are spread out. After setting on this sort of ridge, cover up the roots, gradually working the soil in amongst them, and cover up so that when the trenches are filled in and level with the rest of the bed the crowns of the asparagus plants shall be below the surface about 2 inches. The asparagus plants should be planted about 2½ to 3 feet distant from each other.

Jerusalem Artichoke.—Plant out tubers during the month in trenches about 6 inches deep and 3 feet apart, and drop the tubers about 1 foot apart in the trenches.

This is a good vegetable and useful during the winter, when other vegetables are scarce.

Beans, French or Kidney.—Seed of these tender vegetables may be sown whenever frosts are over. Sow in rows about 2 ft. 6 in. to 3 feet apart. Drill out trenches about 3 or 4 inches deep, and drop the seed in these trenches about 4 to 8 inches apart, then cover over with soil. If the surface of the soil has become hard with rain or wind when the beans begin to appear, loosen it with a fork along the rows to facilitate growth of the young plants.

Beet, Red.—Sow seed in drills about 18 inches apart in good rich soil; but it would be preferable not to apply manure, which is liable to cause the beets to fork.

Silver Beet.—Sow seed in drills about 18 inches apart, and thin out the plants well when they come up—say, to about 18 inches apart. For this plant rich manure may be used, as the object of the grower will be to produce good tender leaves.

Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Savoy.—Sow seed of these vegetables in seed-beds thinly in drills about 2 inches apart. Plant out from previously made seed-beds some of each of above in well-enriched soil.

Celery.—Sow a little seed in seed-bed or box; and when the plants have attained a height of about 2 or 3 inches, prick out to a small well-manured bed where they can grow into strong plants for planting in trenches.

Cardom.—If any young cardoms have been raised, plant them out in well-drained rich soil about 3 feet apart each way.

Celeriac or Turnip-rooted Celery.—This kind of celery grows something like a turnip, and this turnip is used instead of the usual leaf stalk. Sow seed and plant out if any plants have been raised. It is a useful vegetable to grow for flavouring soups, &c., and other dishes. It may be eaten like ordinary celery, or it can be used boiled by itself.

Carrot.—Sow seed largely from time to time during the month.

Cucumber.—Sow seed in districts where frosts are not likely to occur.

Leek.—Sow in a seed-bed, and when the young leeks are about 6 or 8 inches in height transplant to heavily manured shallow trenches.

Lettuce.—Sow in a seed-bed. Plant out any young lettuces that have already been raised.

Melons, Marrows, Squash, &c.—Sow in districts where all frosts are likely to be over. Make the ground rich, and see that it is well drained.

Onion.—Make well-drained rich beds, and sow seed plentifully in drills 12 to 15 inches apart. When the young plants appear, attend well to weeding, which is a most necessary operation in onion-growing.

Parsnip.—Sow largely in drills.

Peas.—Sow largely in rows 3 feet to 3 ft. 6 in. apart.

Potato.—Sow a few rows of early varieties. The kidneys will probably be found most suitable for a family. Drain well, and manure heavily. Plant in rows 3 feet apart, and drop the potatoes about 1 foot apart and about 6 inches deep.

Radish.—Sow a little seed.

Rhubarb.—This vegetable requires rich, deeply dug, well-drained soil. Plant out, just before the shoots start into growth, about 4 feet apart. Let the crown of the plants be just about 2 inches below the surface of the soil where they are covered up with soil.

Salsify or Vegetable Oyster.—A vegetable not much esteemed in this colony, but worth growing for a change. Sow in light rich soil in rows about 15 inches apart. Thin out the seedlings to about 4 or 5 inches apart.

Tomato.—Sow seed, or plant out where frosts are not likely to occur.

Flowers.

All the spring flowering bulbs—the daffodils, jonquils, anemones, ranunculuses, fuchsias, tulips, ixias, sparaxis, and others—are either in blossom or are developing their flower spikes. The flower garden should now be quite gay and pretty, especially towards the end of the month.

The annuals and perennials, known as "tender," may be sown, or, if seedlings have already been raised, they may be planted out—that is, in those districts where frosts are not likely to injure them. All the following kinds are worth sowing:—*Acroclinium album,* and *roseum,* which bear very pretty, everlasting flowers; all the Amaranthus tribe, including the ornamental-leaved varieties, some of which should most certainly be grown. The seeds of these plants are small and hard; they should be sown very thinly, lightly covered with fine soil, and kept well watered. They would be best raised in pots or seed-pans, with sheets of glass over the tops; but when the seeds come up, raise the glass, and keep it raised to admit of necessary air, then in a short time the glass can be removed. Sow also balsams, snapdragons, *Bartonia aurea, Browalia alata,* Coreopsis, Canterbury bells, marguerite chrysanthemums, Clarkias, dahlias of the single varieties; datura or trumpet flowers, larkspurs, pinks of varieties, foxgloves, eschscholtzia, gaillardia of varieties; sunflowers of varieties; holyhocks of varieties; honesty, ipomopsis elegans; sweet peas, lobelias, linums, lupins, mignonette, forget-me-not, dwarf nasturtiums, canary flower, pansies, petunias, double and single; phlox Drummondii; picotees, portulacas, rhodanthi, salpiglots, salvias, stocks, scabious, marigolds, and zinneas. All these are pretty and useful; but there are many other plants of tender kinds which may also be sown.

Bouvardias, camellias, and other evergreens may be planted out in the beginning of the month. It would be better not to risk much later planting, for hot and dry weather may set in early in the spring.

Prune roses of all sorts, except the Banksia, or other kinds which bear flowers on old, ripened wood. After pruning, clean away any white scale which may be present. Use rosin and soda wash, or if this cannot be readily made, use boiled starch. Apply with a brush, and it will soon settle the scale and peel off, carrying the pest with it.

Tea-tree, not Ti-tree.

W. S. CAMPBELL.

By some extraordinary confusion which is quite incomprehensible to me, the word "ti" is very frequently used as a designation for the native plant (or plants) which has for years—ever since the history of Australia began—been known as "tea-tree."

For some reason or other, I find that if I should happen to write the word tea-tree in an article for the *Agricultural Gazette*, that it invariably appears in the printer's proof as "ti-tree," no matter how legibly I may write the word. And this is the case, I believe, with the "Press" generally. Almost everyone sees something occasionally in the newspapers about "ti-tree" bark for packing fruit, "ti-tree" for bush-houses, and so on, and when it happens to be read by anyone who knows what the "ti-tree" really is, the use of the word becomes to him an absolute absurdity.

Such being the case, I think an explanation of the difference between tea-tree and ti-tree will be useful for those who may have become confused in the matter.

The "ti-tree" is that very handsome New Zealand plant, *Cordyline australis*, generally known as *Dracæna*. It is tall, broad-leaved, and branching, and it is very frequently to be seen in suburban gardens about Sydney and Melbourne. In New Zealand it is very conspicuous in the remarkable scenery of that beautiful country, and I found, when there, that it is generally known as the "cabbage-tree," although I learned on inquiry that it is also termed the ti-tree.

Kirk, in his *New Zealand Forest Flora*, says: "This grand palm-lily is commonly termed 'ti,' or, as Mr. Colenso states, properly ti-koura, 'ti' being a kind of generic name applied to the different species of cordyline; it is sometimes termed simply 'koura,' cabbage-tree, by the settlers."

As to using the bark of the ti-tree for packing fruit in, why one might just as well think of scraping off the bark of our own cabbage-tree for the purpose!

So much for the ti-tree; and now for the tea-tree.

The plant indigenous in New South Wales first termed tea-tree, is, I am almost certain, *Leptospermum scoparium*, one of our most common shrubs about the coastal districts of the Colony, and especially prevalent in the vicinity of Sydney.

Rhind, in his *Vegetable Kingdom*, says: "When our distinguished countryman and navigator, Captain Cook, arrived in those distant southern regions, after long and harassing voyages thither, it was amongst his first duties, for preserving the health of his crews, to look for some wholesome herbs on shore as a corrective to the fatal effects of scurvy. The plant, known throughout Australasia as 'Captain Cook's tea-tree,' was found by him to contain a curative principle in addition

to its nutritive property. A decoction of its leaves, drank like tea—hence the name—proved a most efficient medicine. Its leaves are much smaller than those of the tea-plant, but the seed-vessels are very similar. It bears rosaceous white blossoms eight months in the year, and grows most luxuriously on marshy ground from 6 to 20 feet high. What are termed 'tea-tree scrubs' among the settlers are dense thickets of this plant along the swampy margins of streams, where the stems grow as straight and supple as willow wands, which are useful in 'wattling' the sides of huts,—*i.e.*, forming a kind of basket-work upon upright posts to be covered with mortar.

"In Van Diemen's Land and New Zealand, where it grows abundantly, the settlers make a palatable and wholesome beer from it; and in Port Phillip, in 1841, when tea was from £3 to £15 a chest, many of the poorer classes of the settlers used it as a substitute."

I may state here in connection with this plant that James Backhouse, in his *Narrative of a Visit to New South Wales, in* 1837, states: "One of the proprietors (of land at Botany Bay) has established a woollen manufactory. He told us that the branches of *Leptospermum scoparium* answer the purpose of fustic-wood, and dye fawn colour."

Johnston, in his *Chemistry of Common Life*, remarks: "Thus the name 'Tasmanian Tea' is given to the dried leaves of various species of *Melaleuca* and *Leptospermum*, belonging to the order of the *Myrtaceæ*, which are collected in Australia, and used by the colonists instead of Chinese tea. These trees are commonly called 'tea-trees,' and the large tracts of country which are covered with them 'tea-tree flats.' The leaves of various species of *Correa* also, which belong to the *Rutaceæ*, and especially of the *Correa alba*, are collected and used for the same purpose."

When a very little lad I had singular opportunities of hearing yarns, and stories of adventure and customs which obtained amongst old convicts and settlers, from the men themselves; and, in the neighbourhood where I lived, the *Leptospermum scoparium* abounded, and in the same place were many of the other plants now known as tea-tree. This *Leptospermum* was always pointed out to me as the tea-tree which was used in olden days by those who showed it to me.

There is another shrubby plant very common about the coast, but it grows in dryer localities than the above. This is the *Kunzea corifolia*, and it, too, is very generally known as tea-tree.

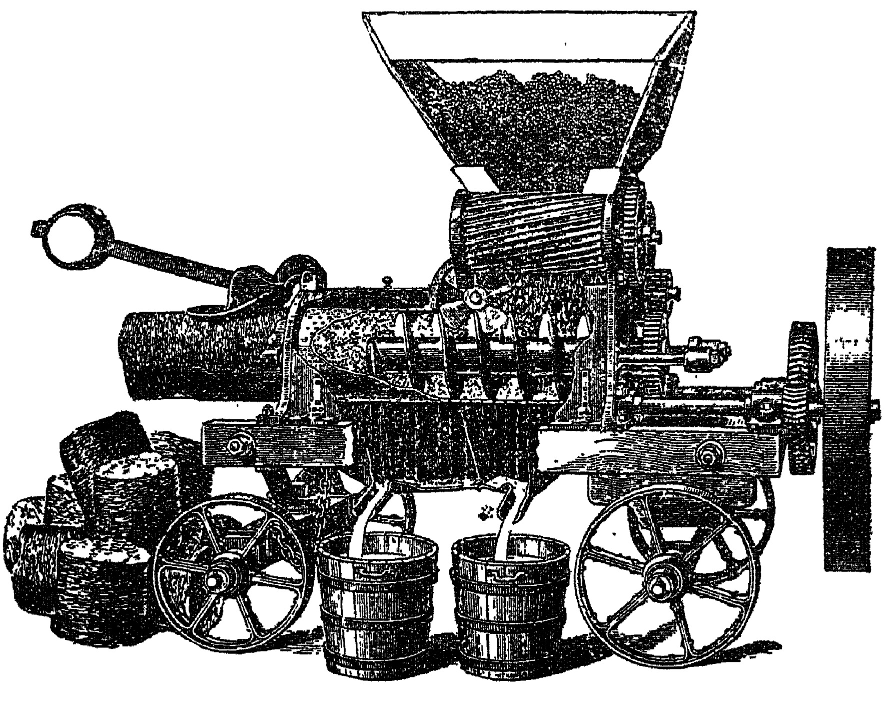
The tea-tree bark used for packing fruit is obtained from the "broad-leaved" and the "prickly-leaved" tea-trees—*Melaleuca eucadendra* and *M. stypheliodies*. These two plants thrive best in swamps and attain a considerable height. I measured one of the last-named at the Richmond River which had been felled. Its trunk was 66 feet in length without a branch, its total height being upwards of 100 feet. The timber is close-grained and very hard, and almost everlasting when used in the ground. Other species of *Melaleuca* are also known as tea-trees.

Then there are the pretty-flowered *Callistemons*, also members of the great Myrtle family, which are known as tea-trees, and I have seen all sorts of shrubs in the country termed tea-tree, but never a one of them ever termed ti-tree.

General Notes.

A Continuous Wine-press.

While on a visit to the Goulburn Valley, Victoria, early in April last, I saw at the Chateau Dookie vineyards one of the above continuous wine-presses. Mr. François de Castella, the manager of this gigantic vineyard, informed me that it would be next to an impossibility to get through the vintage of this 600 acres of full-bearing vines in good time without the use of this great labour-saving appliance. The grapes are pressed in a perforated cylinder, as shown, and



every particle of juice extracted; the mark is ejected almost dry. By means of the press the first must from the grapes may be kept separate from the second pressing. The press when in full work is capable of putting through from 45 to 50 tons of grapes per day. The work is got through much more expeditiously and simply than with the best of the old wine-presses.

I am indebted to the proprietors of *The Australasian* for the excellent block to illustrate this press.—J. L. Thompson.

H

A Jersey Society for Australasia.

Some time ago it was suggested in this journal that it would be to the advantage of Jersey breeders and purchasers of Jersey cattle as well as to the dairying industry if a Society was formed for the purpose of guarding and promoting the interests of the breed. About the same time Mr. Hautrive, who is an old breeder of Jerseys, and a great enthusiast, set to work in a very practical manner to form the desired Society, and it is pleasing to be able to record that he has met with considerable success, most of the breeders of Jersey cattle in the Colony having already handed in their names for membership. On the second day of the Sheep Show a meeting of breeders was convened by Mr. Hautrive, and officers were elected. His Excellency Earl Beauchamp has consented to act as Patron, and Dr. Hay, Coolangatta, will be the first President.

Among the members are such well-known breeders as Messrs. F. A. Wright, M.L.A., H. L. Mackellar, W. A. Long, M.L.C., H. H. Brown, J. D. Cox, W. W. Wren, S. Hordern, D. Hyam, J. B. Christian, F. I. White, J. Anderson, J. McCulloch, and W. Woodmason, of Victoria.

On the motion of Mr. A. Hay, seconded by Mr. M. A. Callaghan, Mr. M. Hautrive was elected honorary secretary to the Society.

It was deemed advisable to give the Society the name of The Jersey Cattle Society of Australasia, so as to admit members from New Zealand, where there are many good breeders.

If kept alive, and there seems every evidence that it will be, such a society can do a vast amount of good. At the present time animals are sold as, and even some win prizes at Shows that can scarcely claim to be classed as Jerseys. Grade Jerseys they might be; but a man who buys a Jersey bull, as he fancies, and then finds him throwing animals of a nondescript character becomes a bit disgusted, and says that there is no use in breeding from pure bred-bulls after all; with the result that mischief is done to the essential point of successful cattle-breeding, and an injury is worked to one of our staple industries. There is no better way to quickly improve a herd than by using well-shaped, well-descended, thoroughbred bulls, and our dairy farmers should never use any other. By keeping milking and butter test records, and registering all pure-bred animals, thus enabling an intending purchaser to see at once where to go to select a bull of a good dairy strain, the Society should benefit our dairy industry. The Society should also be of much use in supervising judging awards, selecting capable judges whose decisions would carry weight with the Society and with breeders, and on many other minor points.

All those in any way interested in advancing pure bred cattle, or the dairying industry generally, are eligible as members of the Society. The President of the R. A. Society, Mr. J. See, has intimated his intention of becoming a member.—M. A. O'Callaghan.

Crop Returns.

Mr. Henry Hamel, who has 300 acres under cultivation in the Armidale district, wants to know how it is that farmers cannot get the crops now-a-days that were common in times gone by—whether it is through lack of manure or of shelter? He thinks lack of shelter is responsible for the falling off. Thirty years ago Mr. Hamel used to get from 20 to 57 bushels per acre, while some of his neighbours reaped as high as 62 bushels of wheat per acre. Now the best returns only go from one to four bags to the acre, and even if an absolutely new piece of ground is used the crop will not, in the most favourable season, exceed from four to five bags per acre.

Remedy for Wire-worm in Potatoes.

Mr. J. E. Cooper, of Dumbleton, Hurstville, writes:—"I notice in last month's issue of the *Agricultural Gazette* a question asked by Mr. Waters, of Hickey's Creek, regarding a remedy for wire-worm in potatoes. If the trouble arises as stated by Mr. Froggatt, it can be overcome by packing the potatoes in kegs or boxes: thus a layer of potatoes, then first cover with wood ashes free from charcoal, then another layer of potatoes, and so on till filled, the last layer of ashes being about 1 inch thick. No covering is necesary, and the boxes can be placed in a cool shed or outhouse. This method has proved effectual with me for several years past in keeping small tubers for seed. I have now some on hand that were packed in the middle of February last. I tried pitting potatoes, and also covering them in boxes with flour of lime (air-slaked lime), both of which were absolute failures. Another advantage with the ashes is that should several of the tubers by any means happen to rot it does not affect the rest. The ashes must be dry, and kept so."

Adobe Walls.

Mr. T. Parkinson, of Sutton Farm, Ording, says he has been trying the method of erecting mud or adobe walls, recommended in the *Gazette* some time ago by Mr. Phepper. He finds the plan easy to carry out, and the work can be done more speedily and with half the labour; but if any rain falls on the walls while building they will melt like sugar.

Best Time for Ringbarking.

Mr. F. G. McPaul, of Midlands, near Pambula, finds that ringbarking when the trees are in full fruit, and the sap is well up in the tops, is most effective.

Saltpetre Treatment for Burning Stumps.

Mr. H. T. Blanch, of Rous, Richmond River District, detailing his experience in this method of getting rid of stumps, says:—"The stumps I operated on were dry swamp mahogany, and in a very wet season. Allowing the saltpetre to remain for about three months, the stumps were fired. The result was that the top only of the stumps was burnt." This communication, it is regretted, does not furnish much evidence either way. It is absolutely necessary to allow a sufficient time (some authorities say at least six months) to elapse before commencing to burn, and it is customary to start the fire with a little kerosene poured in the hole in which the saltpetre has been placed. Mahogany stumps are fair terrors to deal with, and if it can be proved that by the systematic use of a few pennyworth of saltpetre and kerosene they can be easily got rid of, much time and labour of the hardest possible nature will be saved. Where the stumps burn off close to the ground, it is not a bad plan to get a good solid lump of wood, or a stump, and place it on the charred one. As soon as the fire is going well, cover it carefully with clods. The fire will smoulder away underneath and follow the roots well below any possible cultivation.

An Inverell correspondent, Mr. J. R. Thatcher, of Oakwood, writes:—"About fifteen years ago I tried the saltpetre treatment on four stumps of white box. They were solid, and from 15 to 22 inches through. I bored a hole with a $1\frac{1}{4}$-inch auger in a slanting direction about 4 inches from the top towards the centre, about 9 inches deep; dissolved the saltpetre in water until no more would dissolve, and poured it in the holes and corked them up until well in the spring (it was May when the saltpetre was put in). I then took the cork out and found the bore empty, so I filled the holes with kerosene, and let it soak for a few days. I then put a shovelful of coals on top of each stump, thinking they would burn out, but the fire took no effect. Some time after that I placed a heap of wood around each stump, but the fire again took little effect. Three of the stumps have disappeared by degrees, and the fourth throws up shoots every year. These stumps had been cut down about two years. I have no faith in the treatment, and think it a failure."

A Clean Orchard.

Mr. George Pratt, of Old Junee, writes:—"I have no disease or insect pest of any kind in my 9 acres of fruit-trees and vines. I had a little aphis on the peach-trees three years running, but have now got rid of it by using remedies recommended in the *Gazette*."

Clean Orchard Land.

Mr. J. Plowman, of Minto, says that, as a result of keeping his orchard land scrupulously clean, he has little bother with insect pests.

Deep cultivation for Vegetables and Fruit.

Mr. Geo. Hollowell, of Kenthurst, writes:—"By working the ground deeply so as to conserve moisture I have had very good results; in fact, I find that by working the soil a foot deep and keeping it clean, I get as much crop from a fourth of the land as I used to get from the whole area."

Corrosive Sublimate for Potato Scab.

Mr. J. Edwards, of Rosewood, Armidale, says he has tried a solution of corrosive sublimate, 2 oz. to 16 gallons water, for potato scab, with fairly good results. The potatoes dug from seed, so treated, were found to be a great deal freer of scab than those not treated at all. In cases where large tubers are used for seed, it is best not to cut them till after they have been soaked, as a freshly-cut potato soaks up too much of the solution, which, in some cases, causes the set to rot.

Smut in Wheat.

Mr. Peter F. Orr, of Michelago, writing in reference to a letter from Mr. P. Cosgrove, of Ganmain, on the subject of smut in wheat, says: "I have been farming in the Monaro district since 1865. 1865 was a dry year, and I had 20 acres under Red Lammas. The crop was too short to reap so I had it pulled by hand. From then up to 1873, I was always troubled with smut, and sometimes with rust as well.

"In 1873, I washed over 1,000 bushels of wheat full of smut balls. I washed the grain in a large tub of clean water. I put the wheat on a drying sieve and dipped it in the tub, when all the smut floated and was brushed off the top. The wheat was then spread on a cloth to dry which did not take above three hours, as it was a very short time in the water. I sold the resulting crop to a Queanbeyan miller for 5s. 3d. a bushel. Since 1873, I have not been bothered either by smut or rust.

"I might mention that I tried White Lammas, White Tuscany, Purple Straw, and what they used to call Rust-proof Wheat, and the smut affected all more or less.

"In answer to questions asked of some of the oldest farmers as to the cause of the smut, I was told that I did not make my bluestone solution strong enough, or steep the grain long enough, which I ultimately found was pretty correct. Now, I am quite sure if Mr. Cosgrove will treat his wheat in the following manner he will not be troubled with either smut or rust:—Get a cask that will hold a bag of wheat. Dissolve 1½ lb. bluestone and the same amount of Liverpool salt. To that add sufficient water to cover the wheat in the cask about 4 inches. If the wheat is pretty good let it soak ten or eleven hours; but if the grain is pinched, add more bluestone and salt, and let it soak from twelve to fourteen hours, but not less than twelve, as pinched wheat has a thick bran, and the liquid does not soak in so quickly as in good plump grain, which has a thin bran.

"But I would advise all farmers to avoid sowing pinched grain if possible. As a small weedy potato will produce thin weedy stalks, so will weak seed-wheat grow a weak stalk, as it has not body enough to send out strong roots like a good plump seed has.

"I might here mention that up to 1895 I always grew my own seed-wheat, but I am sorry to say that, owing to so many bad seasons, I have run out of all my seed. My mode of getting good seed is to go through the crop just before harvest and pick the best ears, and sow the seed from them in a small patch as if I were doing gardening. This is the only way, I think, to get good seed.

"Then good seed should be sown in well-prepared fallowed land. It does not take long to raise a stock of good seed in this way.

"To anyone having smut in a crop from seed treated with bluestone, I would say, *make the liquid stronger*. Farmers have told me that if they made the bluestone water too strong it would kill the grain, as they have seen some of the seed quite blue after it has been soaked, which is quite true. The reason of this is that the seed was cracked, although the crevices may have been invisible; but some wheat in stripping or threshing is bound to be more or less cracked. This can be seen if the wheat is placed in hot water. Any cracked grains will open out a little. In travelling around the district with a stripper, I have had many opportunities of noting the results of various methods of treatment to prevent smut, and of seeing how successful the one I have described is.

"Someone has drawn attention to the freedom from smut of self-sown wheat. The reason why this is so is owing to the drying such wheat gets lying so long in the sun. If all seed could be dried in the same manner as the self-sown, it would not want any other treatment.

"It might be added that White Lammas wheat and side-bearing oats appear to be most suitable for the Monaro."

The Effects of Poisoned Birds upon Pigs.

Mr. Charles Wyndham, of Mt. Vincent, speaking about the effects of the carcases of poisoned birds upon pigs which eat them, says:—"As an old squatter I have had great experience in poisoning birds and dogs with strychnine. I have repeatedly poisoned the whole carcase of a sheep, and have seen pigs eat up every bit of the flesh without showing any ill-effects. I am quite sure strychnine will not poison pigs."

Good Results from Draining.

Mr. Donald Mackinnon, of Coraki, has adopted the advice of the *Gazette* with respect to underground draining, and the results are beyond his expectations. He says: "This district is liable to gluts of rain, and the soil being of a non-porous nature, the crops used to perish. Now, by the underground drains drawing off the surface water, the crops get a chance, and are good and uniform."

RESULTS OF NEW SOUTH WALES WHEAT HARVEST, 1898–99.

District.	Methods of Cultivation and Sowing.	Seeding.	Date of Sowing.	Best Yielding Varieties. 1st.	2nd.	3rd.
Albury	Deep cultivation ; thorough pulverisation	Thin	Early	Sullivan's Early Prolific	Steinwedel	White Lammas.
Balranald	„ ploughing ; thorough cultivation	„	„	Allora Spring	„	
Bathurst	„ cultivation ; thorough pulverisation	„	Medium	A. Talavera	White Lammas	Golden Drop.
Cudal	„ „ „ „	„	Early	Purple Straw.		
Coonabarabran	Thorough cultivation	„	„	„	Talavera	White Lammas.
Cootamundra	Drilled in land well worked	„	Early—Late	Allora Spring	Steinwedel.	
Condobolin	Deep and thorough cultivation	„	„	Steinwedel	Allora Spring	Rattling Jack.
Corowa	„ cultivation ; thorough working	„	„	Purple Straw.		
Dubbo	„ and thorough cultivation	„	....	„	„	White Lammas.
Forbes	Good cultivation	„	Early—Medium	Steinwedel.		
Gulgong	Deep	....	....	„	Purple Straw.	
Hillston	„ cultivation ; thorough pulverisation	Thin	Early—Medium	Allora Spring	Steinwedel	Purple Straw.
Hawkesbury	„ and thorough cultivation ; drill	„	....	Steinwedel	Allora Spring.	Tardent's Blue.
Jerilderie	„ cultivation ; thorough pulverisation	„	Early	„		
Mungeribar	„ thorough cultivation ; drill	„	„	„	Purple Straw	Allora Spring.
Mudgee	Drilled in well-cultivated land	„	„	Silver Streak		
Narramine	Deep cultivation ; fallowing land ; thrice ploughing	„	Medium	Purple Straw	Steinwedel	„
Orange	„ thorough cultivation	„	....	White Lammas	Blount's Lambrigg.	
Parkes	Thorough cultivation	„	Medium	Steinwedel.		
Tamworth	Well cultivated	„	Early	„	Rattling Tom	Purple Straw.
Warialda	Deep and thorough cultivation	....	„	„		
Wagga	„ cultivation ; thorough pulverisation	Thin	„	Marshall's No. 8	Golden Drop	Marshall's No. 3.
Wentworth	Drilled in land ; worked well	„	„	Steinwedel.		
Gunnedah	Deep cultivation ; thorough pulverisation	„	„	„	Purple Straw	Allora Spring.
Junee	Shallow cultivation	....	Early—Late	Purple Straw.		
Urana	Fallowed land	....	„	Steinwedel	Purple Straw.	
Moama	No particulars sent	Thin	„	„	Allora Spring.	
Gunbar	„ „ „	Medium	Medium	Purple Straw	„	
Wellington	Thorough cultivation	....	Early	Steinwedel	„	
Armidale	....	....	Medium	White Lammas	„	
Spring Hill	Deep and early cultivation	....	Early	„	Purple Straw	Hyland.
Millthorpe	....	Medium	„	Purple Straw	Steinwedel	Allora Spring.
Singleton	....	....	Medium	Campbell's	Cameron's	Steinwedel.
Coolabah	Deep cultivation ; thorough pulverisation	Thin	Early Drill	Hudson's P. S.	Steer's P. S.	Berthoud.
Bourke	Under irrigation	„	Medium	Allora Spring	Australian Talavera.	
Young	Deep cultivation	„	„	Steinwedel.		
Cowra	....	„	„	„	Hudson's Purple Straw.	
Bolero	Deep cultivation	„	„	„		
Manildra	Shallow cultivation	„	Early	„	Exhibition Purple Straw.	
Rylstone	Deep cultivation ; thorough pulverisation	„	„	White Talavera	White Lammas	Purple Straw.
Narandera	Well cultivated	„	Early—Medium	Steinwedel.		
Temora	Drilling deep ; thorough cultivation	....	Late	„	Purple Straw.	

It will be seen from the preceding return that from forty-two of the chief wheat-producing districts of the Colony, Steinwedel is returned in twenty cases as giving the best results; and from six districts it is given as giving the second best results. Purple Straw is also favourably mentioned, White Lammas, and in some cases Allora Spring. It is further noted that in nearly every instance deep cultivation, thorough pulverisation of the soil, thin seeding, and early sowing have given the best results. I am fully of opinion that if our farmers would cultivate the soil more thoroughly, raise or select good seed, sow thinly, use the drill, and a little fertiliser when necessary, cultivate the growing crops, that the average yield of wheat would be increased fully one bag per acre. In a year or two we will have, at least, 2,000,000 acres under this crop, which, with the extra yield mentioned, would mean 2,000,000 bags of wheat. At an average of 10s. per bag amounts to £1,000,000 sterling to the pockets of our farmers and the coffers of the State. I am satisfied that with better methods of cultivation this could be easily achieved.—J. L. Thompson, Government Agricultural Instructor.

Preparation and Application of Farm-yard Manure.

Mr. W. Hessel Hall, M.A., of Lapstone Apiary, Emu Plains, has been good enough to furnish the following report of his operations:—"My business is of the nature of *petite* farming, and through the knowledge of scientific agriculture, acquired in connection with the Belmore Medal Course of Agricultural Science at Sydney University, and in part from the *Gazette*, I have, within four years, been able to turn a barren gravel ridge into a garden, to build up a very pleasant home, and make a modest income. This has been accomplished with limited expenditure, and by means of very much manual labour. The articles on draining, cultivation, manuring, pruning, and on vegetable and animal pests, have been very serviceable. Part of my land I have underdrained, worked deeply, and heavily manured. Such ground has returned heavy and profitable crops—nearly all for home consumption in house and for poultry and stock. I have had very heavy crops of strawberries, and during the hot dry weather the plants on the drained, thoroughly-worked land, were green and vigorous, whereas on the imperfectly cultivated portion even the trees almost perished. I take especial care of all farmyard manure, rotting it down under cover as far as pressure of other work allows. My experience, extending over some years, is that thoroughly-rotted manure gives a much better return than the raw manure. I attribute this to the fact that in the heap the conditions are much more favourable to decomposition and recombinations than in the field; also to the fact that the heat generated by decomposition tends to burn plant-life off unless the season be very wet. I find, however, that considerable labour is necessary to secure the proper moistening and forking of the manure in order to get a perfect rot. I make considerable use of fowl-dung. For field crops, I broadcast it dry.

In this case the effect is not immediate, and the dressing not sufficient to burn the crops; while for winter crops, the heat of decomposition may even be an advantage. For strawberries, fruit-trees, and garden stuff, this manure is especially valuable, producing a vigorous and healthy growth in vegetables, and in the case of fruit, inducing exceptional size and flavour. For garden and orchard use, I find it fatal to use this manure in any quantity unless thoroughly rotted. A perfect rot, however, can be secured by proper mixing and wetting in a cask or case in from three to four weeks. The principle upon which I have worked this unpromising spot is the very opposite of that adopted by some farmers, who try to take everything out of the soil and put nothing in. I have endeavoured to put more into the soil than I have taken out, and to that end I bring, yearly, as much additional plant-food on to the place, through the agency of poultry and stock, as my crops consume."

NUTS.

"I AM one of those who, unlike Darwin, believe that men and women have degenerated much from what they have been," writes Mr. J. S. Crawford, of Tamworth, "and that human beings should not die from senility until much over 100 years of age. I also think improper food has much to do with this falling off, and I further think the fats of different animals used as food have a most relaxing and degenerating effect. Now, in order to produce an oily, carbonaceous food we should look to nuts. Nut-trees, especially those which do not root too deeply, should be extensively cultivated. Two that I think should be well worthy of attention are the Queensland nut, *Macadamia ternifolia*, and the Japanese chestnut." It is certainly a misfortune that nuts are not more generally grown in the Colony. In some of the colder districts nearly all the best varieties of European and American nuts should thrive to perfection. Most of the nut-trees are of a most ornamental habit of growth, and could be studded about the place here and there to serve as shade trees as well as grown in rows along the fences for shelter purposes. Once walnuts, chestnuts, or any of the other common kinds get a fair start they require little or no attention, and though there may be but a trifling return from them they might just as well be planted as trees which return nothing at all. As showing the place nuts occupy in the dietary of the country districts of France, the following extract from the *Journal of the Society of Arts* is of interest:—

Nuts as Food in France.

THROUGH the centre of France, from the Bay of Biscay to Switzerland, there are large plantations, almost forests, of chestnut-trees. The poor people through the autumn and winter, often make two meals daily from chestnuts. The ordinary way of cooking them is to remove outside shell and blanch them. The blanching is done by throwing the nuts into boiling water, and with a *briquette* rubbing them around the kettle until the inside skin peels off. The *briquette* is composed of two square pieces of wood, 24 to 36 inches long, the angles of which are notched about 1 foot up; they are joined like shears with a rivet. After the blanching process, a wet cloth is placed in an earthen pot, which is almost filled with raw chestnuts; they are covered with a second wet cloth, and put on the fire to steam. They are eaten with salt and milk. Hot steamed chestnuts are

carried round the city streets in baskets or pails; the majority of the working people, who usually have no fire early in the morning, eat them for their breakfast, with or without milk. These nuts are often used as a vegetable, and are exceedingly popular, being found on the tables of the well-to-do and wealthy. They are served not only boiled, but roasted, steamed, cured, and as dressings for poultry or meats. Chestnuts are made into bread by the mountain peasantry. After the nuts have been blanched they are dried and ground. From this flour a sweet, heavy, flat cake is made. It resembles the oaten cakes so popular among Scotch peasants. The United States commercial agent at Limoges says that when these nuts are stored they are very apt to heat and ferment, and great care must be taken to prevent this. They are placed in cool, airy bins, so that the air can readily pass through the pile and perfect ventilation be obtained. The walnut-tree is very generally grown all over France, but more especially in the central and eastern departments. Walnuts, as an article of food, are losing ground in France because of their scarcity. The trees have been in great demand for timber and furniture-making; nevertheless there are certain sections of the country in which these nuts form a regular article of diet. The peasants eat them with bread that has oftentimes been rubbed with garlic. The hygienic effects are considered good, replacing meat to a large extent. These nuts are also used to make oil. It is much cheaper and similar in taste to that pressed from olives, and is employed to adulterate the latter. The prisoners in certain prisons are, says the commercial agent, engaged in cracking walnuts and picking out the kernels, which are pressed for oil. Almonds are largely exported from France. The climate of the middle and southern departments of the country are most favourably adapted to the growth of this fruit. In the summer, the almond, while the shell and husk are soft, green, and tender, is sold by the dozen or hundred in the markets, at from ½d. to 2½d. per dozen, according to the condition of the crop. The meat is white and creamy. As an article of food they are not used as extensively as chestnuts and walnuts. Almond oil is employed for various purposes. Apricot stones are often ground with almonds to adulterate the oil. Confectioners and bakers consume large quantities of these nuts in making different kinds of cakes and sweetmeats. Hazelnut-trees are only grown for their fruit, and although they will flourish in nearly all the departments, the nuts are considered a luxury, and are always high-prized. Hazelnuts are eaten green, like almonds, in the summer, when they are sold at more reasonable rates. The exportation from France is unimportant. The peanut, so common in the United States, is very rarely eaten roasted in France, and nearly all that enter the ports are imported from Spain, Italy, and Africa. The variety is small and uninviting, and very high in price. The taste for these nuts, as a food, is said to be growing. Many tons of peanuts are imported from the west coast of Africa, India, and the Malayan Archipelago, and are sold in Marseilles and other centres. They are principally bought for the oil which is extracted from them. Peanut oil is used for cooking purposes, and as an adulterant and substitute for olive oil. Many physicians in different parts of Europe have been making experiments as to the nutritive and medicinal qualities of all kinds of nuts, and have advanced views favouring their use as food, under certain conditions, for special diseases. Nuts contain a special kind of salt, especially adapted for lubricating and softening the muscles. Some practitioners claim that elderly people would be benefited by a more extensive nut diet. The only evil to be overcome is that the nuts should be thoroughly masticated.

In Victoria some slight attention has been paid to the more extended culture of some varieties of nuts. Speaking about the chestnut, the *Australasian* says:—

The cultivation of the tree commonly known as the Spanish chestnut has hitherto made but little progress in the Colony. About Melbourne and in many other places in Victoria the climate is a trifle too dry and warm for it to thrive in, but in the cooler districts it does admirably. The tree does well in any ordinary good soil, but a deep sandy loam with a dryish subsoil suits it best. Soils containing a large amount of lime are not suitable for chestnut growth. The land should be well drained and also trenched to a depth of 18 inches or 24 inches. Under favourable circumstances, the tree attains a large size; it should, therefore, be planted from 30 feet to 40 feet apart. As a purely ornamental tree, for planting in shrubberies, avenues, or the park, the chestnut is most suitable. It lives to a great age. A tree in Gloucestershire, England, measured 52 feet round the trunk, and was supposed to be 1,100 years old. The famous chestnut of Mount Etna, under the branches of which it is said that Jean of Arragon, attended by 100 cavaliers, took shelter in a storm, was an enormous tree, the largest on record, its trunk being upwards of 200 feet in girth. Victorian nurserymen catalogue three or four varieties only of chestnuts, but in Europe and in America there are numerous kinds, some of which are species, others merely varieties raised from seed. Japan is rich in

chestnuts ; there are the Japan Giant, Japan Mammoth, Japan Sweet, and many others. Individual trees of these have found their way to Victoria, but they do not seem to have been propagated and distributed. Chestnut-trees raised from seed vary as much as apple or peach seedlings; it is only by budding, grafting, layering, or by cuttings that any special kind can be perpetuated. So great is the uncertainty of obtaining really good kinds from seeds, that it is stated that out of 10,000 seedling plants received from Japan by the noted fruitgrower and hybridist, Luther Burbank, only three were deemed worthy of propagation. Even the grafted trees exported by the Japanese cannot be relied upon, for out of a thousand trees received by an American nurseryman, only one was selected as being of first-rate excellence. Some of the American varieties of chestnuts are pronounced to be superior in flavour, in sweetness, and in delicate texture to any of the European or Japanese kinds, but the nuts are smaller. The trees are generally upright and free-spreading, and attain a large size. The Japanese chestnut is a semi-dwarf, close-headed tree, with slender willowy branches, and of a distinct ornamental value. The foliage is small, resembling that of the peach, though a trifle larger and thicker. The large nuts ripen a month or six weeks earlier than the European ones. The trees are very prolific and hardy, and the foliage is said to be quite free from the fungus disease which often attacks the European chestnuts. American *Gardening* says there are great possibilities in the future in improving the chestnut by careful and intelligent hybridising. The ideal chestnut is one with the flavour of the American, with the vigorous habit of the European, and the size and early ripening of the Japanese. Why the prefix Spanish is applied to the eatable chestnut is not very clear; the tree is found more plentifully in Italy and other parts of southern Europe than in Spain. All of the named European kinds are descended from the French Marrons, a class name given to the improved French kinds. The fruit of the chestnut was at one time considered to be very nutritious. It is still an important article of food in France, Spain, Italy, and Japan. The nuts in their raw state are not considered to be very digestible ; but roasted and eaten with salt, they are more wholesome. When ground and made into flour, and mixed with wheat or other meal, the chestnut comes largely into use as a staple food. At one time the nuts were stewed in cream ; they were also used in soups, and for stuffing turkeys. The wood of the chestnut is valuable, and years ago the trees were largely cultivated for their timber. It is light, coarse grained, very durable, and will last well in water. For many purposes it is quite equal in value to the oak. At one period the wood was much used in England for making beer and wine casks. The bark of the tree is astringent, and occasionally used for tanning and dyeing purposes. The chestnut is seldom attacked by ordinary insect pests.

Citric Acid Making.

According to the *California Fruit-grower,* lemon-growers in the States are beginning to devote some attention to the manufacture of citric acid.

It appears that the bulk of citric acid has hitherto been made in Italy by a slow hand process, but American ingenuity is developing machinery which will soon make the manufacture of this article an important industry, which will absorb culls and other unsaleable fruit in the citrus districts. In Philadelphia a factory has been established some time, supplies of concentrated lemon-juice being imported from Italy for treatment. In New South Wales it will be some time before there is likely to be sufficient surplus lemons to make it worth the while of anyone to establish a citric acid factory ; but still it is encouraging to note that fresh avenues are opening for the disposal of what are now not only waste products but often disseminators of disease.

Lime for Pumpkin Beetles.

As a protection against the ravages of pumpkin beetles, Mr. R. McGregor, of Toorisdale, Cambewarra, finds lime dusted in the young pumpkin leaves very successful. The leaves are not injured in any way.

Treatment of Vines for Anthracnose.

Mr. H. B. McFarlane, of Rooty Hill, reports that he has found the treatment of his vines in winter with sulphuric acid and sulphate of iron for anthracnose, followed by Bordeaux mixture spray in early summer, thoroughly effectual in eradicating the disease. Latterly he finds the winter dressing alone is sufficient.

Destruction of Insectivorous Birds.

A Glen Innes correspondent reports that a good many people in that district ruthlessly destroy insectivorous birds. Many farmers, under the impression that the magpies were guilty of pulling up the young shoots of grain crops last year, lose no opportunity of dealing out destruction to the unfortunate warblers, which, in the opinion of our correspondent, are really useful birds.

Arsenical Soda with Bordeaux Mixture for Citrus Pests.

Mr. W. H. McKeown, of Gordon, finds Bordeaux mixture quite effectual for Maori on his orange-trees. He is using arsenical soda with Bordeaux mixture for destroying white louse and other diseases the Bordeaux does not touch, and finds it very satisfactory. For codlin moth Mr. McKeown uses brown-paper bandages, which he examines every week.

Harrowing the Young Wheat Crop.

Mr. D. McKerrell, of Chatsbury, has been trying the effect of harrowing the wheat crops when about a few inches high, as recommended in the *Gazette*. He says the idea would have been considered the height of madness in his district at one time, but his experiments leave no room for doubt as to the great advantages of the system.

Mr. H. A. Lowe, of Mudgee, also writes about the excellent results of harrowing wheat crops, and says he loses no opportunity of impressing upon the farmers in his neighbourhood the benefits of such a practice.

Bordeaux Mixture for Root Fungus.

Mr. G. McClymont, of Forrester, *via* Windsor, reports that he has found Bordeaux mixture, injected into the soil around several mandarin trees badly affected with root fungus, a complete cure.

Australian Talavera at Tamworth.

Writing about his wheat experiments, Mr. A. H. MacGowan, of Winton, near Tamworth, says:—"I got a bushel each of Allora Spring, Berthoud, and Australian Talavera two years ago from the Wagga Experiment Farm. The Talavera was a great success. I sowed 10 acres of this wheat last season, and harvested with a stripper 280 bushels, or 28 bushels per acre. I have sold the bulk of it to my neighbours for seed, so that it will have a good trial round here this year. I find that Talavera does not shake out like Steinwedel or Purple Straw.

"Winton is a new settlement. The holdings are small and the land first-class wheat soil; but it will wear out in time and get weedy and wheat-sick. As soon as I can afford to do so, I will sow cowpea in my oldest ground (which has got oaty). I would like to know, however, where I am to get the seed for, say, 10 acres.

"The people here are thrifty, and many of them successful farmers. Most of them believe in the old style of farming, and Steinwedel and Purple Straw are the two wheats principally grown. I must say that both do very well so far."

Flat Cultivation of Corn and Potatoes.

Mr. George Keena, of Ballengarra, *via* Port Macquarie, has been trying the system of flat cultivation of maize and potatoes recommended for certain districts in the *Gazette*, and says:—"Level cultivation in corn and potato crops, with frequent use of the horse-hoe as near the surface as possible, has been attended with such beneficial results in the crops, especially maize, that they did not seem to feel the hot, dry, weather, and yielded well. I tried it the season before last on 12 acres of my crop, with the result that I determined to discard the use of the plough altogether for hilling growing crops, and I now use nothing but the horse-hoe on the flat system."

Ploughing under Cornstalks.

Mr. D. D. McLeod, of Dunregan, Tinonee, speaking about modes of maize-culture, says:—"I consider the ploughing under of cornstalks a failure, unless you have a drooping year, as the turning in of so much rubbish keeps the land too open for our dry springs. So far as I can gather, the system has been abandoned here for the reason I give. We have to plant our maize when we get the rain."

In connection with this subject, it may be mentioned that Mr. Owen McCosker, of Cherry Tree Hill, Inverell, reports that the principal corn grown in his district is of a variety known as "Prairie Queen." It yields, as a rule, from 30 to 50 bushels per acre, is early, and the stalks are very light and easily got rid of.

Preparing Land for Sugar Beets.

In spite of all that has been said on this subject in agricultural journals, as well as in our text-books, experiment station bulletins, the circulars of sugar-factories, &c., there is, says an American grower, still much ignorance among farmers as to the real value of sugar beets for fodder purposes, and the means to adopt to bring the crop to the highest stage of perfection.

The best soil for the sugar beet is a strong, rich, well-drained loam, with a porous subsoil. The beet does well on a great variety of soils, provided the land is properly prepared; but at the start only those fields should be put into the crop that from the best obtainable knowledge are believed to be well adapted to the beet. It is important that the land should be in good heart, and, so far as possible, free of weeds.

The main thing is deep working. Here is where the average farmer errs when he begins beet-culture, and, indeed, most other root crops. If he could spend a day or two among the experienced beet-growers of California and see how they plough to a depth of 12 inches, and how they cultivate with straight-toothed cultivators to a depth of 10 inches or so before seeding, it would be an object-lesson that the beginner would profit by. Deep ploughing is needed, because the beet is a deep-rooting plant. To make the best growth, richest in sugar, the soil must be so deep that the plant will bury the top of the root under the soil, as the parsnip does, and at the same time be able to send its taproot down without let or hindrance.

Autumn ploughing is best, but where this is not practicable, put on a stout team and plough 7 to 10 inches deep, provided you do not turn up an inch or two of fresh soil that has never before seen the light of day. In many cases, too much of this fresh soil on the surface will retard germination of beet-seed and interfere with the best development of the young plants. The ordinary plough should be followed by a subsoil plough that will stir the subsoil several inches below the depth reached by the first plough, but not throw the subsoil on top. The more compact the subsoil, the more necessary does this subsoiling become. Indeed, it cannot be dispensed with, at least, where the entire preparation of the land must be done this spring.

Having thus reached a depth of 12 or 15 inches with the two ploughs, put on a spiked-toothed harrow with long teeth, and weight it so that it will reach as far down as the first plough went. If you have a narrow-toothed cultivator for such deep work it would be still better. There are various forms of cultivators or harrows that can be used. This will give you a soil thoroughly pulverised down to a depth of 8 or 10 inches, and quite well opened up to a depth of 12 or 15 inches. The surface should now be prepared for seeding by going over it with a light harrow, or some similar machine that will make a seed-bed 2 or 3 inches deep in a perfectly fine condition. If the soil is very dry, and there is danger of its blowing in heavy winds, it may be well to roll it.

Now sow your seed in drills 20 inches apart. A variety of excellent seed-drills or machines is available for this purpose. Better use too much than too little seed, as the beet is not successfully transplanted. If the soil is reasonably moist and the weather warm, thus favouring germination, several pounds less per acre may be used than if the land is wet and the air cold. Better use 15 or even 20 lb. of seed per acre than have a slim stand because of too little seed. This is a point upon which there are great differences of opinion, and in California all the way from 3 to 20 lb. of seed per acre are used, but experienced growers there usually plant about 10 or 12 lb. The rows should be 20 inches apart to permit of horse cultivation, but 14 inches apart will do for hand-culture. Be sure that the rows are absolutely straight. If a seeder is used that plants two to four rows at a time, try to have a horse-hoe or cultivator adjusted in the same way that its wheels may run on the track of the seeder. This will adapt the horse-hoe to any little crookedness in the rows, and enable the driver to cultivate close to the row without cutting beets. If within a reasonable time the beets do not come up well, re-seed wherever there is a poor stand.

Improving Potatoes by Selection.

"One of the first methods for securing improved varieties of potatoes I ever put into practice," writes Mr. W. E. Imes, Michigan, in the *American Agriculturist*, "was suggested by Nature's effort to assist in this work. Some plants are favoured in growth by conditions we may not be able to analyse or determine, but we may note the striking individuality of some particular plants, vigour of stalk and perfection of foliage, as compared with tho other specimens of the field. Do not fail to stake such plants, as they often possess more energy and power of transmitting desirable characteristics to future crops than may be developed by several years of careful manipulation. By this method some of the most striking specimens in the plant world have been secured. At the time of greatest plant vigour go through your fields, having a number of small stakes with you, and mark these conspicuous hills. With five minutes' work then you can go in the field when the crop is mature and easily secure the cream of the season's growth.

"Selecting seed from the cellar to increase vitality is a more difficult task, and an actual knowledge as to variety is necessary to secure the best results. The two main points to be considered are size and eye development. The largest potato with the best eye development is the one with the greatest vitality, hence it follows that the largest seed-piece with the least number of eyes is the better for the purpose, and not over three eyes should be used in any case. I put myself on record as opposed to the selection of smooth-eyed potatoes for seed. Now the features of the eyes of a potato are the characteristics of the type when originated, and when the potato begins to 'run out' through any cause whatever the eyes always get smaller, never larger. So select the tubers with stem-end eyes that protrude. The eyes of the middle and of the main seed-end should

show a bulge below—that is, toward the stem end. Any tendency toward coarseness will be eradicated by field cultivation and ordinary conditions, and especially with the use of small seed as is often used. If your field selection has been large enough, the smooth and medium-sized stock may be used the first season for your general field crops with excellent results, using only best specimens for seed propagation.

"The protruding stem-end eyes will give best results if each piece to be planted weighs 4 or 5 oz. If there should be more than one eye to 3 oz., cut the poorer ones out, as the above class of eyes generally produce several original stalks. The indented eyes in the middle and towards the seed-end are generally single stalk-producers, and two eyes may be used, cutting out extra eyes if less than 5 oz. Use no small pieces in any case. Plant 3 feet apart each way on your best soil, and care for thoroughly. Repeat your selection from seed-plot instead of field, using product of seed-plot as soon as the amount is large enough for your general field crop purposes. Repeat your selections each year, and your seed-plot will keep you supplied with the best of seed. With your selections made each year, almost any sized seed will give good results, whereas if you simply take from your crop the medium and small-sized potatoes, the road to 'run out' seed is only a short one.

"For my own fields the seed is graded for three years, except, of course, new varieties, so that I never have to use common stock. I thus make a complete renewal of stock each season. As a result, I never get a new sort but once. For example, the old and well-known Rural New Yorker No. 2, which I have grown since its introduction, is producing heavier crops than ever, and is also finer in quality. See that you have the best, then grade it with the same care you would your farm stock, and to every farmer or potato-grower who plants even an acre each season the above suggestions will, if followed, increase net profits from one-third to one-half."

Disappearance of Fruit-fly at Inverell.

Mr. Benjamin Pennington, of Apple-tree Farm, Inverell, writing about his experience of the fruit-fly, says he has always taken the precaution to destroy all his infected fruit, but last year all his late peaches were attacked and nine-tenths of the crop were not fit for use. He says: "I had five well-shaped late peach-trees, about four years old. The fruit had come to maturity in the early part of March, 1898. The peaches were large and very fine, all full of grubs. I was so disgusted I told my boys to dig them out; but other work pressing, the trees were left standing. This season, to my surprise, there was a good crop of fruit, and no grubs at all; in fact, they were the finest and best-flavoured peaches in the orchard, and I sold them at 3d. and 4d. a dozen. I had two entries of them at the Inverell Show. I think the dry time we have experienced may have had something to do with exterminating the fruit-fly, as the greater part of the fruit around Inverell was free from grubs this year. If you think proper to make a note of this matter, it may be the means of inducing fruit-growers who are troubled with pests and inclined to uproot trees, not to be in too great a hurry."

THE VALUE OF A NITROGENOUS TOP-DRESSING.

A SOUTH AUSTRALIAN wheat-grower, Mr. W. Pearson, who also grows other crops, and every year does a little in experimental manuring, gives it as his opinion that in almost all cases it is best to work the manure—bone-dust or superphosphate—into the land. For wheat, oats, and barley, he thinks that a special superphosphate is preferable to bone-dust, but he does not think either contains enough nitrogen. For leguminous plants, however, such as peas, beans, vetches, lucerne, &c., which derived their nitrogen from the air, they were all that was required. It was his intention in the future to use bone-dust liberally for the pea crop, and in the following year to put in a hay crop without manure on the same land, giving it a top-dressing when from 3 to 6 inches high, or at any time should it assume an unhealthy appearance, using nitrate of soda or sulphate of ammonia for this purpose. He tried this plan last year, with astonishing results. He sowed a crop of oats in May, and in July top-dressed with 1 cwt. of nitrate of soda per acre the poorest part of the land, on which the oats were very sickly—in fact, it could scarcely have looked worse. Within a fortnight it had recovered, and from thence grew splendidly. At harvest this portion yielded about 35 cwt. of hay per acre, as against 15 cwt. from the other portion; so that for an outlay of 12s. he got a ton of hay, if not more, extra, as if this part had not been manured it would not have gone more than half a ton to the acre.—*Leader.*

POTATOES FOR FATTENING PIGS.

WHENEVER potatoes are very cheap farmers are apt to try to get something out of them by feeding them to stock. Every year there is a certain proportion of potatoes too small or too scabby to be marketable, and some of these are likely to be given to the fattening hogs with the idea that their starch can be converted into fat. But only 20 per cent. of the potato is starch, the other 80 being nothing but water. Even when cooked the potato absorbs as much water as it loses, and is much too bulky in the small stomach of a hog to serve as its principal feed. Beyond the small amount required to keep the bowels open, it has been proved (says the *American Cultivator*) that potatoes are no advantage to the hog, and for this a few beets, which the hog will eat with greediness, are greatly to be preferred.

REPORT ON SEEDS RECEIVED FOR TRIAL.

MR. D. MONTGOMERY, of Saw-mills, forwards the following report on seeds of cow-pea (two varieties), chick-pea, red clover, and millet, received from the Department for trial in his district:—"On account of the drought none of the seed had a fair chance. The cow-pea sprang up, but soon withered away; the chick-pea did well considering the drought. One of the best bushes stood about a foot high, and 1 ft. 6 in. across. I counted the pods on one bush, and they amounted to 202. The red clover did well, attaining a height of about 1 foot. The millet grew 3 feet high, and bore a heavy crop of seed. The highest temperature we had in summer was 90° in the shade."

Potato-growing.

The finest quality of potatoes can be grown on sandy soil, but the heaviest yield is usually obtained where there is considerable vegetable or alluvial deposit. Potatoes can be grown profitably on almost any soil, with the exception of heavy wet clay.

The yield will be largely governed by the preparation of the land. A thorough ploughing in the autumn is undoubtedly the best, for a deep soil will hold moisture, and thus be in a better condition to withstand drought. Potatoes are also a deep-feeding crop, and for this reason require a deep, mellow soil, in which their roots can ramify in all directions.

In order to obtain the best results, plenty of barnyard manure should be applied, as few crops will give such good returns from manure as the potato. If applied in the autumn, plough under. If not put out until later, it can either be ploughed under lightly or thoroughly mixed with the surface soil by means of a cultivator. Do not plant land until it is in just the right condition, as there is nothing that pays so well as thorough tillage. Where sod is to be planted, it is immaterial whether it be ploughed in the autumn or not. Many of the most successful growers differ upon this point. Some prefer a clover sod ploughed in the spring, and the surface well cultivated, to any other preparation. It would be advisable to plough an old turf in the autumn so as to allow it to rot before spring. The early varieties should be planted as soon as the land can be thoroughly prepared in the spring. For the later sorts cultivate the land again, and plant as soon as through with the other spring seeding. If good results are to be obtained, perfect seed must be chosen. Select medium-sized, well-formed, sound potatoes, free from scab. Practical growers advise different methods of cutting, while some do not cut at all. The usual method, however, with the best growers is to cut in pieces containing from two to three eyes.

Potatoes may be planted either in hills or drills. Though the yield will be much the same in either case, the latter method is preferable, for the planting, cultivating, and harvesting can be much more easily accomplished since horse-labour will, to a large extent, take the place of hand-work. Many very successful growers still plant in hills. The drills may be 30 inches apart for small varieties, and 33 or 35 for the more growthy sorts. Ten to 12 inches is a good distance apart in the rows. Cover 2 or 3 inches deep with the plough, or if the furrows were ridged together, a plank, scraper, or coverer may be used, which would cover two rows at once. A common and very successful way is to plough the land lightly, planting in every third furrow. Those who grow potatoes on a large scale will find it profitable to use a regular planting machine.

If dry weather is feared roll the land immediately after planting. Harrow the ground just as the potatoes are coming through. It will be wise to repeat this once or twice. Never plant potatoes in a field where the crop was formerly affected with either the rot or the scab, for there will be a sufficient number of spores left in the ground for several years to spread the disease. If either of these diseases is feared the best remedy is to spray with Bordeaux mixture at intervals of two

weeks. In order to destroy the beetles at the same time, Paris green may be added in the usual proportions, viz., 1 lb. to 200 gallons of the mixture.—G. F. MARSH, Ontario.

CANADIAN FARMERS' INSTITUTES.

"THE organisation of Farmers' Institutes is permitted under an Act passed for that purpose by the Ontario Legislature. One institute may be organised in each Electoral District or Riding, on condition of having fifty members, each paying an annual fee of twenty-five cents. The institute year begins on the 1st of July and ends on the 30th of June. The annual meeting is held in June each year, for submitting reports, election of officers, and selection of places for holding meetings for the following year.

"Officers consist of a President, Vice-President, and Secretary-Treasurer, who, together, form the executive committee; and one or two Directors from each municipality in the district. All memberships terminate on the 31st of December. The organisation and carrying on of institute work is strictly non-partisan and non-sectarian, and subjects on these lines shall neither be presented nor discussed, but such subjects only as are calculated for the equal benefit of all citizens and farmers generally. The objects of the institute are as unselfish as they are non-political. The real object and purpose of the institute seems to be greatly misunderstood by very many, and looked on as something of very little importance to them as individuals or the communities where they are held. These meetings, if properly appreciated and attended, must surely be a powerful agency or means of diffusing knowledge of the best and most successful methods of farming. We can learn much from the experience of practical men who come to address the meetings on the intelligent application of practice and principles that are approved of by successful men. We can learn from the experience of each other. We can exchange ideas and discuss questions pertaining to our business, both in producing, caring for, handling, and marketing our various farm products. Only a few years ago our Government, under the Dairymen's Association, sent out men who were called cheese instructors and milk inspectors. These men not only assisted the cheesemakers in the most approved methods of handling milk and manufacturing the finest quality of cheese, but by thoroughly and carefully testing the milk of all patrons, and instructing them in the proper care and handling of the milk, the best varieties of food, the necessity of good, pure water, &c., they encouraged and assisted those who were ready and anxious for improvement, and to a large extent compelled the careless and dishonest patron to co-operate in furnishing a good quality of milk to the factories. The result of this wise movement has been the placing of our cheese product on the highest pinnacle of fame, and creating for ourselves a name and prestige among the nations of the world which we would not perhaps have otherwise enjoyed; and as 'eternal vigilance is the price of liberty,' we must be earnest and vigilant in our efforts to maintain the proud and enviable position we have striven so hard to reach. The question that agitated and weighed on the minds in those Dairymen's

Conventions was, how shall we reach the masses?—and, while the instructor system has reached many in the one particular industry, it appears to me that the solution of this great problem—the best and most complete answer to this great question—is through the Farmers' Institute. While the dairy industry is one of very great inportance and interest to us as a people, we believe there are other phases of agricultural life, and other lines of agricultural industry, that are of equal if not greater importance. There is a great work for the institute to do in bringing to the masses the knowledge of the most scientific and practical methods of carrying on and developing these industries. There is the poultry and egg industry, the bee industry, the small fruit industry, all or any of which may furnish very profitable employment and investment for many of our people. It will be a grand thing for us as agriculturists when we rise to a proper appreciation of our position, when we realise that there is no higher or nobler calling, none that requires greater intelligence, thought, or study. We need more information—more light; we need to become more enthusiastic in our avocation and in our pursuit after knowledge respecting it. In what way can we secure so much valuable light and information at so little cost as through the Farmers' Institute? The reports and bulletins, as they come to us, contain a very large amount of useful information; and in our meetings our intercourse tends to bring us into closer relationship with each other.

"Prof. W. C. Latta, of Lafayette, Ind., comprehensively summarises the work of the Farmers' Institutes when he says: 'They have done much to destroy the feeling of antagonism between town and country, which has been so prevalent; to foster friendly relations among the agricultural classes themselves; to increase the general intelligence of the farming classes; to foster the desire for the more thorough education of farmers' sons and daughters as a means to higher success and greater happiness on the farm; to point out the causes of failure and the conditions of success, and thereby improve the methods of agriculture; to awaken new interests and pride in agricultural pursuits; to lift those classes up to a higher plane of living and achievement, and to a clearer recognition of the duties, responsibilities, and privileges of the farmer as a business man, neighbour, and citizen.' I am glad that both our Dominion and Provincial Governments have given us enthusiastic men as Ministers of Agriculture. May it ever be so. This encourages us to hope that our calling will receive due care and attention. We have received many individual testimonies regarding the benefits derived from the institutes held thus far, and we sincerely hope and trust that every member will do what he can to induce his neighbour to join and share in the advantages it brings. The Government and our indefatigable up-to-date Superintendent have certainly done much for us in providing such a school of agriculture within the reach of all. Surely such an institution has great possibilities, and, properly conducted, may prove wonderfully effective in the promotion of good neighbourly feeling as well as intelligent and profitable farming. Such an institution should be ably and loyally supported by those to whose aid it comes."—Address by Mr. J. G. Foster, Moira.

Replies to Correspondents.

Dimensions of Bar-frames.

Mr. C. Kaiser, of Sackville, asks for information as to the proper width of bar-frames for bee-hives. "I read," says he, "in all the text-books that the top bar should be $\frac{7}{8}$ inch and bee-space $\frac{3}{8}$ inch; but in measuring specimens of self-spacing frames, I find that they are $1\frac{3}{8}$ inch overall. Is this correct, or should they not be $1\frac{1}{4}$ inch overall? I have first started this last season as a bee-keeper, and as I am a 'chips' by trade, have made, and will make, my own hives and frames. Those I have made already contain self-spacing frames $1\frac{1}{4}$ inch overall. If this is wrong, I should like to know the reason why." Mr. Kaiser also asks for a recipe for honey beer, mead, and honey vinegar.

In reply, Mr. Albert Gale reports:—The text-books give for the top bar $\frac{7}{8}$ inch, and bee-space $\frac{3}{8}$ inch=$1\frac{1}{4}$ inch. That is, the measurements for frames that are not self-spacing. This permits closer or wider spacing according to circumstances that are well known to practical bee-keepers; such as aiding to check drone-breeding by giving less bee-way, or, where there is a heavy honey flow, spacing wider in the supers. Machine-made self-spacing bar-frames are $1\frac{3}{8}$ inch, but frequently it is necessary to space a little wide with them, especially when used in the super. There is nothing wrong in making self-spacing bar-frames $1\frac{1}{4}$ inch, only it does not give sufficient room for the bees to cluster on the young brood, and, under such circumstances, it may interfere with regularity of the combs if, when required, they are not spaced a little wider. Recipes for honey beer, &c., will shortly be published in the *Gazette*.

Alleged Destruction of Grape by Bees.

In reply to Mr. C. Leonard, of Glen William, who asks for advice as to the means of preventing bees eating grapes, Mr. Albert Gale says bees do not injure grapes by eating holes through the skin. Birds, especially those known as little silver-eyes, first puncture the fruit, and then bees take advantage of it, but only when other food is scarce.

Little Black Ants and Bees.

A great many people go to no end of trouble to protect their bee-hives from invasion by small black ants.

As a matter of fact, reports Mr. Albert Gale, these little visitors do not interfere with the bees. They frequently form their nests between the cover of the hive and the quilt, and often between the top bar of the frame and the quilt, but never in the hive amongst the bees. If they are carefully observed it will be seen that the ants never trespass within the frames, or molest the bees. If anyone desires to see how

the bees treat any ants that dare to intrude, let him throw a handful of ants in amongst the bees. In less than five minutes the bees will have bundled them out. Of course, where the colony is weak, every effort should be made to keep out intruders.

Mixing Dry Fodder with Green Stuff in Ensilage.

MR. W. J. McPHERSON, of Ingleside, writes:—"Last year I experimented in a small way with ensilage out of a maize crop which was a failure as far as cobbing was concerned. I built a square-cornered, oblong silo, *above* ground, roofed with iron. For the frame I used 3 in. x 2 inch hardwood; for sides, floor, and ends thoroughly-seasoned 6 in. x 1 in. T. and G. hardwood. The side and end boards were placed perpendicularly. Underneath the floor was a clear space of about 6 inches. I chopped the maize-cobs and everything together, with some half-dried maize-stalks, into ¾-inch lengths, trampling it well down occasionally, and particularly round the edges and corners. When all was finished I covered it with boards, putting weights on top. I was not particular to any special weight per superficial foot, in view of the statement in the *Gazette* that ensilage might be made in a silo without any weight at all. Result:—End of one month, 3 to 6 inches under surface was slightly warm and mouldy. In two months the lot seemed to be rotten, so consigned it to manure pit. I would like some information as to the cause of failure. The mistake I think I made was in putting the half-dried stalks in, and also that some of the other stuff might have been too old, as the whole crop was very uneven."

Mr. J. L. Thompson, Travelling Instructor in Agriculture, reports:—Mr. McPherson is correct in thinking that the dry stalks were the cause of failure in his ensilage. Dry fodder of any kind should not be mixed with succulent green stuff in making silage, because the dry stuff draws moisture from the green, and consequently moulds. Dry fodder may with advantage be mixed with moist silage when taken from the pit and fed to stock.

Most suitable source of Potash for Potatoes.

IN answer to Mr. W. Drakeford, of Tambaroora, Mr. F. B. Guthrie, chemist, says that sulphate of potash is considered a more suitable manure for potatoes than kainit, the chlorine in the latter being found objectionable. Sulphate of potash may be, and is generally, applied when planting.

Getting rid of Bracken Fern.

MR. C. A. SPROULL, of Kurrajong Heights, has raised a question as to the most effective means of getting rid of bracken, which is a great source of trouble in the orchard lands situated in the foot-hills of the Kurrajong, as well as in many other districts.

Mr. Allen, Fruit Expert, thinks the only way to get rid of the bracken is to plough deeply, picking up and destroying all the roots exposed. Liquid scrub exterminator, and other specifics for noxious plants, have been tried, but without success.

Fowl Ticks at Wellington.

MR. W. FLYNN, of Wellington, has brought under notice specimens of a pest attacking fowls in the Wellington district. He says:—"They are termed ticks here. It will be noticed that they vary in size. The smaller ones attack the poultry in myriads and clusters, and breed very rapidly. The fowl, when infested, becomes paralysed in the legs, and its flesh becomes very dark in colour. The pests seem to me to make their attacks at night, as no sign of them (except in the cracks of wood) can be seen during the day."

Mr. McCue, Poultry Expert at the Hawkesbury Agricultural College, reports that the specimens are the true fowl tick (*Argas reflexus*), and are of different ages, from a week old up to two or three months. These ticks hide in crannies in the perches and walls during the day, although some of the smaller ones will remain on the fowl sheltered among the feathers.

Treatment.—First clean out all houses, burn the perches, nest-boxes, and fixtures, search the walls, and apply kerosene oil to every crevice and cranny. Swing new perches, by hanging them from the roof with fencing wire, and stayed with the same material to keep them from swinging. Tie a piece of rag or cloth round the wire in a couple of places, and keep the rags well saturated with kerosene.

Catch all fowls and search for ticks; they will be found under the wings and around the vent generally. Have a clean bag spread out to place the fowl on while being dressed. Apply kerosene oil to every part where ticks find lodgment, and remove as many of the parasites as possible, dropping them into a saucer of kerosene. Burn the bag after you are done dressing the fowls.

Mange on Horses.

IN answer to a correspondent at Maclean, who asks for information concerning the treatment of mange on horses, Mr. J. D. Stewart, Veterinarian to the Stock Branch, says this disease, commonly called Queensland mange, was very prevalent in the North Coast district during last summer, a great number of horses being disfigured by it. It is a difficult disease to cure, as many powerful medicinal and anti-parasitical agents have failed to produce good results. During Mr. Stewart's recent visit to the north this disease was specially noted, and an effort will be made next summer to demonstrate the cause of the complaint, in order to ascertain an effective and cheap remedy.

"Crampy" Cattle.

MR. W. B. FOY, of Karuah, asks: "What is it that causes cattle to become what is locally known as crampy? Is it the grass they eat, or the country they walk on? The cattle swell in the legs, fall off in condition, and continue unthrifty, even some of them dying. If removed to sound, good country, they do well. The run I have gives it to almost all cattle *bred* here. Cattle sent here from other parts do well for a period of three to six months. The ground is not suited to

breeding, as far as I know. It consists of large areas of salt marshes (locally considered good country), gentle slopes, stony ridges. The timber is ironbark, all gums, mahogany, tallow-wood, bloodwood, stringybark, &c., and large areas of tea-tree scrubs, with large areas covered with grass-tree (some look on this as the cause). The grass is kangaroo mainly. There is a large fresh-water marsh in it (dry in summer). It is heavily timber, and, if rung, the suckers and seedlings grow very thickly, and it is impossible to keep the seedlings down. I have a big frontage to the Karuah River (salt)."

Mr. J. L. Thompson, Travelling Instructor in Agriculture, says that some time ago Mr. Pottie, Lecturer in Veterinary Science at the Hawkesbury Agricultural College, reported that conditions apparently identical with those described are produced in cattle which eat the young shoots of grass-tree after rain. The shoots contain a resin, and the effects upon the animal's system are loss of appetite, condition, energy, and vitality, followed by weakening of the hind-quarters. This weakness becomes gradually a prominent symptom, and paralysis of the hind-quarters follows, the animals dying from exhaustion and exposure induced by such weakness and paralysis.

Treatment.—Remove the cause, presumably grass-trees. Gradually improve the pasture by sowing such grasses as Prairie, Timothy, Cocksfoot, &c., and especially *Paspalum dilatatum*. Topdress where practicable with lime, and add lime to drinking-water. Give the affected beasts large doses of oil, followed by tonics such as sulphate of iron, quinine, ginger, gentian, and sulphur; or a suitable tonic-lick could be made to place in troughs.

Generally speaking, the complaint is an obstinate and difficult one to treat.

Spaying Pigs.

In response to Mr. Ezra Harvey's (Curran's Creek, Crookwell) request for information on the spaying of pigs, Mr. J. L. Thompson, Government Agricultural Instructor, sends the following particulars:—Sow pigs not required for breeding purposes should be spayed before being weaned, as any check they may get is lessened, because they have their mother's milk to nourish them. If spayed afterwards it is particularly necessary that the sows be dieted before being operated upon and for a day or two afterwards. A great proportion of the losses sustained from the operation are due to the neglect of this precaution. Spayed sows fatten much better than unspayed. They become restless on each occasion on coming into season. The meat also is whiter and of better quality.

Sidney, on the pig, writes, referring to unspayed sows:

> The plaguey pigs are never worth their meat,
> They never feed, nor are they fit to eat.

Mild weather should be chosen, if possible, for the operation; extremes of heat and cold avoided.

The following particulars of the operation have been received by Mr. Thompson from Mr. William Squires, Manager of the Labour

Farm, at Loongatha, Victoria, and an old officer of Dookie Agricultural College:—"The best time to do this is when the pigs are six weeks and not over eight weeks old. The pigs should not be supplied with any food whatever for twenty-four hours previous to the operation, after which they may be fed with a little dry grain of any description, but only just sufficient to keep them from starving. Water may also be supplied. The pigs should be kept on short commons for three days after operation. When large quantities of food is allowed the pigs blow themselves out, and burst the two or three stitches which are put in to close the incision. Nice, genial weather should be chosen, avoiding all very hot or very cold days. After spaying it is very important that the floor of the pen is dry; thus, a wooden floor is the best, as there is less danger from inflammation. About three hours after the operation, if the pigs are hustled up together, they should be quietly stirred up, and made to walk around the pen a few times, this helps to counteract any liability to stiffness in the off hind leg, which might happen if the pigs were allowed to lie in the one position for some hours. Repeat this at intervals during the first two days after spaying. A fattening pig has but two things to attend to, viz., eat and sleep; thus the barrow pigs, especially when penned off by themselves, always do better than sow pigs. The latter are in season about every three weeks, and if there are ten of them in the one pen, the chances are that the lot are in a continual uproar, as one pig in season at a time is quite sufficient to upset all the others. Spaying stops all this; 95 per cent. of the pigs thereafter will be as quiet as the barrow pigs, and may be kept with them. The difference in the value of 'spayed' pigs in England at twelve weeks old is from 3s. to 4s. per head better than for 'unspayed' at above age. Two persons are required to conduct the operation. The body of the pig is laid across the right foot of the operator, who holds the head of the pig firmly to the ground by pressing with his left foot. The assistant takes the two hind legs of the pig one in each hand, and pulls them backward, so that the loin of the pig is pressing against the ankle of operator. Thus, firmly secured in every way, the pig can offer no resistance other than the 'squeal,' which always accompanies the operation. Taking the flank of the pig in the left hand, it is pulled outwards to further tighten the skin, when an incision is made with a round pointed knife midway between the flank and hip-bone. The forefinger of right hand is inserted and the womb found, and immediately worked towards the opening, the left hand assisting by a downward pressure so as to help the forefinger inside. (Care should be taken that the whole of the womb is taken out; neglect in this respect generally accounts for the 5 per cent. which do not keep quiet after spaying.) When it is all worked to the outside of incision, it may be cut off with a sharp knife. The assistant now releases the top or off hind leg of the pig, thus allowing the skin around the flank to slacken, when the stitches (about three of them) are put in and securely knotted, and the operation is completed except a little dressing of some sort to keep away flies (in summer weather)."

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society	A.B. Chippindall	Jan. 11, 12
Lismore A. and I. Society	T. W. Hewitt...	,, 18, 19
Gosford A. and H. Association	W. McIntyre ...	,, 20, 21
Kiama Agricultural Association	J. Somerville ...	,, 25, 26
Wollongong Agricultural Association	J. A. Beatson ...	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery ...	,, 7, 8
Manning River A. and H. Association	W. Plummer ...	,, 9, 10
Liverpool Agricultural Society	J. E. Wilson and G. L. Sutton, Hon. Secs.	,, 9, 10, 11
Berrigan Autumn Show	R. Drummond...	,, 15
Ulladulla A. and H. Association	C. A. Cork ...	,, 15, 16
Lithgow A. H. and P. Society	M. Asher ...	,, 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society	E. H. Sargent...	,, 17, 18
Tumut A. and P. Association	M. McNamara ..	,, 22, 23
Alstonville A. Society	N. R. Elvery ...	,, 22, 23
Port Macquarie and Hastings A. and H. Society ...	J. Y. Butler ...	,, 23, 24
Bega A., P., and I. Society	John Underhill..	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes) ...	John Priest ...	,, 1, 2
Robertson Agricultural and Horticultural Society ...	R. G. Ferguson	,, 2, 3
Upper Murray (Tumbarumba) P. and A. Society ...	W. Willans ...	,, 7, 8
Tenterfield Intercolonial P., A., and M. Society ...	T. W. Hoskin...	,, 7, 8, 9, 10
Cudal A. and P. Society	C. Schramme ...	,, 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood.....	,, 8, 9
Oberon A. H. and P. Assoc.	Alfred Gale ...	,, 9, 10
Berrima District (Moss Vale) A., H., and I. Society ...	H. Richardson...	,, 9, 10, 11
Castle Hill and District A. and H. Association... ...	F. H. Rogers ...	,, 10, 11
Cobargo A., P., and H. Society	T. Kennelly ...	,, 14, 15
Southern New England P. and A. Association (Uralla)..	P. M. O'Connor.	,, 14, 15
Inverell P. and A. Association	John McGregor	,, 15, 16, 17
Nepean District (Penrith) A., H., and I. Society ...	E. K. Waldron..	,, 16, 17
Gundagai P. and A. Society	A. Elworthy ...	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 16, 17
Candelo Agricultural Association	C. H. Brooks ...	,, 16, 17
Cumnock P. A. and H. Assoc.	W. L. Ross ...	,, 17, 18
Walcha P. and A. Association	F. Townshend...	,, 21, 22
Blayney A. and P. Association	H. Woolley ...	,, 22, 23
Upper Hunter (Muswellbrook) Agricultural Society ...	J. C. Luscombe	,, 22, 23, 24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Bangalow A. and I. Society	John R. Wilson	,, 23, 24
Crookwell P. and A. Association	M. P. Levy ...	,, 23, 24
Warialda P. and A. Association	W. B. Geddes...	April 5, 6
Gulgong A. and P. Assoc.	C. E. Wilton ...	,, 7, 8
Mudgee Agricultural Society	J. M. Cox ...	,, 11, 12, 13
Cooma P. and A. Assoc.	C. J. Walmsley	,, 12, 13
Clarence P. and A. Association	Jas. C. Wilcox..	,, 13, 14
Lower Clarence Agricultural Society (Maclean)... ...	G. Davis ...	,, 18, 19
Richmond River (Casino) A., H., and P. Society ...	Jas. Tandy ...	,, 19, 20
Hunter River A. and H. Association	W. C. Quinton..	,, 19, 20, 21

Society.	Secretary.	Date.
Orange A. and P. Association	W. Tanner, jun.	April 26, 27, 28
Wellington P. and A. Soc.	R. Porter ...	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	....	,, 4, 5
Coonamble P. and A. Association...	F. C. Lamotte...	,, 10, 11
Dubbo P. A. and H. Assoc.	H. Munckton ...	,, 9, 10
Hawkesbury District A. Assoc. (Richmond)	C. S. Guest ...	,, 11, 12, 13*
Mudgee Agricultural Society	J. M. Cox ...	,, 16, 17
Walgett P. and A. Assoc.	Thos. Clarke ...	,, 17, 18
Durham A. and H. Assoc.	C. E. Grant ...	,, 17, 18
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20
Moree P. and A. Society	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Assoc.	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association	N. A. Read ...	,, 1, 2
Parkes A. and H. Association	J. H. Lane ...	,, 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Soc.	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
Moree P. and A. Society	S. L. Cohen	,, 30, 31 September 1
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Moama A. and P. Association	C. L. Blair ...	,, 13
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Germanton P. A. and H. Society	G. T. S. Wilson	,, 20, 21
Yass P. and A. Association...	W. Jermyn ...	,, 21, 22
Temora P., A., H. and I. Assoc.	W. H. Tubman	,, 27, 28
Burrowa P. A. and H. Association	F. H. Tout ...	,, 28, 29
Holt-Sutherland H. and P. Society (Miranda)	E. Thacker ...	October 2
Berry A. Association	A. J. Colley ...	Dec., 6, 7, 8

1900.

Dapto A. and H. Society	A. B. Chippindall	Jan., 10, 11
Wollongong Agricultural Association	J. A. Beatson	,, 31, Feb., 1, 2
Alstonville Agricultural Society	N. R. Elvery ...	,, 14, 15
Robertson A. and H. Society	R. J. Ferguson...	Feb. 29, Mar. 1
Tenterfield I. P. A. and M. Society, Show	T. W. Hoskin ...	Mar., 6, 7, 8
,, ,, Fair days	,, ...	,, 9, 10
Lismore A. and I. Society	T. W. Hewitt ...	,, 7, 8

* Entries close 20th April.

[9 plates.]

Sydney: William Applegate Gullick, Government Printer.—1899.

PLATE I.—A TYPICAL BLACKBUTT FOREST; THE METHOD OF LOADING LOGS; AN[D]
A PORT OF SHIPMENT.

Vol. X. Part 9. *SEPTEMBER.*

The Timber Trade of New South Wales.

R. DALRYMPLE-HAY,
Officer-in-Charge, Forestry Department.

THE scope of this article does not include trade in, or manufacture from, imported timber, which to some extent competes with the colonial-grown product, nor does it aim to be sufficiently comprehensive to embrace all the industries which have grown with the business of felling timber and its conversion to marketable commodities.

Generally the principal commercial timbers, their felling, transport, milling, and uses, will be treated, giving the most reliable particulars available as to the number of mills engaged in the industry, the number of hands and power employed, value of plant, and the approximate annual output.

Excluding centres in which trade is of purely local character and of insignificant extent, the North and South Coast and the Murray River districts only will be dealt with.

Acknowledgment is made in connection with the distribution and uses of timbers, to the publication "Commercial Timbers of New South Wales," by J. H. Maiden, F.L.S., Government Botanist.

North Coast District.

This district, so far as the timber trade is concerned, extends from the waters of the Hawkesbury to the Queensland Border and inland from the coast, for distances up to 50 miles. The principal centres of activity within it are in the vicinities of Port Stephens, the Manning, Macleay, Clarence, and Richmond Rivers, and Port Macquarie, these being the principal ports with shipping facilities, although shipments are made with more or less difficulty from many other places along the toast, and in nearly every case the timber shipped finds its way by small vessels to Sydney, either for metropolitan and inland use, or for reshipment. Generally speaking the North Coast shipping ports contain what is known as bar entrances, which do not readily permit navigation by vessels of large tonnage, consequently in timber shipment flat-bottomed scows and coasters of light draught are largely used.

The North Coast is looked upon as the principal timber district of New South Wales, and rightly so, for there can be found in larger variety and profusion, the principal Eucalypts and other timbers of commercial value referred to generally as hardwoods, as well as a large variety of figured and ornamental timbers frequently referred to as soft-woods in contradistinction to the hardwoods, and known under the general classification of brush timber.

According to the latest returns available, there are in this district eighty mills at work, employing a total of 1,262 hands, 1,927 horse-power,

plant to the value of £83,220, and with a gross annual output of about 54,500,000 superficial feet of timber. These figures do not, of course, include many minor timber industries, such as the pile and girder, sleeper, spoke, fuel, stave, and other special trades, in which a large number of persons find employment, particulars of which are not readily obtainable; but, nevertheless, give a fair approximation of the proportions of the established timber trade of the district.

The principal timbers obtained from this district, and the market uses to which they are put, are briefly indicated in the following table:—

Vernacular.	Botanical.	Colour of Timber.	Principal Characteristics	Uses.
		HARDWOODS.		
Grey ironbark ..	Eucalyptus paniculata ..	Pale	Heavy, hard, great strength, curly grain	Girders, beams, piles, sleepers, posts, naves, spokes, shafts.
Blackbutt . .	" pilularis ..	" .. .	Strong and durable . ..	Wood-paving, house and ship building, railway waggons, planking, fencing; a useful timber for general purposes.
Tallow-wood ..	" microcorys	Yellow to pinkish.	Heavy, strong, durable; works well.	Flooring, wood-paving, decking, railing, girders, posts, rails.
White mahogany..	" acmenoides ..	" .. .	Hard and durable	Wood-paving, posts, piles, girders, and general building purposes.
Spotted gum ..	" maculata ..	Pale yellowish brown.	Tough and durable; bends readily.	Wheelwrights' and coach-builders' work, shafts, poles, naves, spokes, agricultural implements, tram-rails, framing, house-building.
Red mahogany ..	" resinifera ..	Rich red ..	Very durable, hardens with age.	Wood-paving, fencing, weatherboards, general building purposes, heavy furniture.
Grey gum	" propinqua ..	Red	Strong and durable	Wood-paving, short girders, sleepers, posts.
Sydney blue gum..	" saligna ..	Pale red ..	Durable, straight grained, works well.	Wood-paving, ship and wheelwrights' work, building purposes, wheel felloes.
Turpentine ..	Syncarpia laurifolia ..	Dull red, varies to brown.	Durability, difficult to burn	Piles for bridges, wharfs, jetties, posts, pillars.
Brush box.. ..	Tristania conferta.. ..	Pale	Tough, strong, durable ..	Tram-rails, yokes, decking, mallets, toolhandles, planes.
		SOFT AND ORNAMENTAL WOODS.		
Red cedar	Cedrela australis	Red, darkens with age.	Light, figured, soft, easily worked, very durable.	Furniture, joinery, cabinets, boat-building, carriage-building, carving, ceilings, doors, frames, and many minor purposes.
Rosewood	Dysoxylon Fraserianum..	Reddish ..	Works well, neat figure, fragrant odour, durable.	Furniture, cabinet-work, turnery, carving, indoor work, piano frames, show-cases, &c.
Black bean ..	Castanospermum australe	Dark, resembles walnut.	Fine grained, dresses and polishes well.	Furniture, cabinet-work, and many of the uses of walnut.
Red bean	Dysoxylon Muelleri ..	Reddish ..	Works well, quiet, handsome figure, durable.	Furniture, ornamental lining, and many of the uses of Spanish mahogany.
Onion wood ..	Owenia cepiodora.. .	Red	Very similar to red cedar ..	Many of the uses to which red cedar is put.
White beech ..	Gmelina Leichhardtii ..	Pale, with tinge of brown.	Close grained, does not readily expand or contract, works excellently.	Flooring, decking, house-fittings, frames, blocks, carving, casks, vats, and ordinary carpentery.
Colonial pine ..	Araucaria Cunninghamii..	White	Soft, durable if not exposed to weather, easily worked.	Flooring, lining, ceilings, packing cases, butter boxes.
Silky oak	Grevillea robusta	Light	Fissile, durable, handsome figure.	Casks, kegs, buckets, shingles, frames, lining, and other ornamental purposes.
She oaks .. .	Casuarina species.. ..	Red to deep red tints.	Hard, heavy, tough, fissile, blotchy grained.	Shingles, staves, yokes, ornamental turnery and cabinet-work, veneers.
Tulipwood ..	Harpullia pendula ..	Black to yellow shades.	Tough, close grained, durable, and beautifully marked.	Cabinet-work, billiard tables, panels, dadoes.

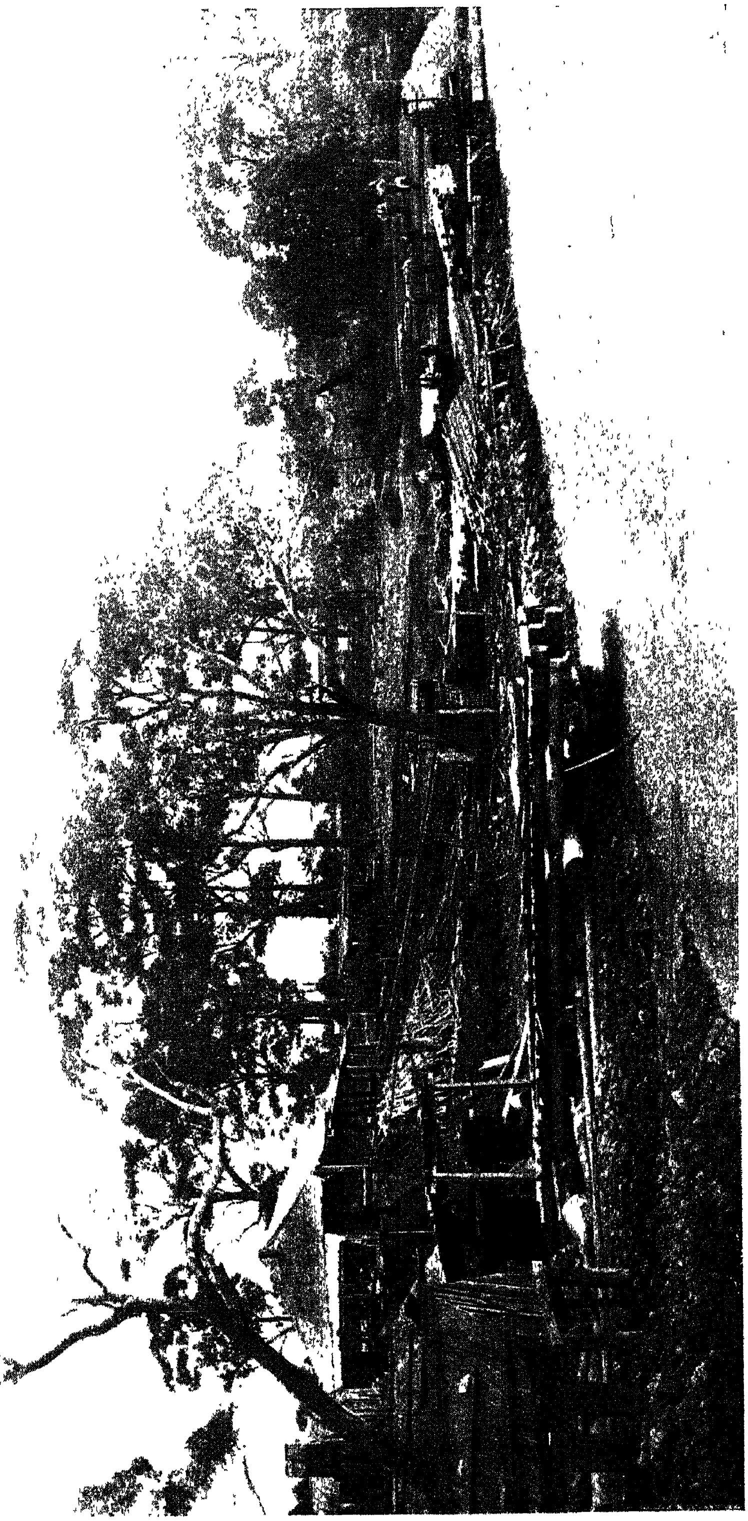


PLATE II.—A TYPICAL RIVER-SIDE TIMBER MILL.

South Coast.

The South Coast timber district, which ranks second in importance for the supply of hardwoods, extends from Port Hacking to Twofold Bay and inland for 20 miles. The principal centres of activity within it are in the vicinity of Jervis and Bateman's Bays, Moruya, and Wagonga; Jervis Bay being a port navigable for vessels of large tonnage. Timber from this district is also shipped at other ports of less importance than those mentioned, and like the product from the north coast, most of it finds its way to Sydney in the first instance before re-shipment. From the latest returns, there are in the South Coast District twenty-eight mills at work, employing a total of 203 hands, 465 horse-power, plant to the value of £11,175, and with a gross annual output of about 5,000,000 superficial feet of timber. From this portion of the Colony, and largely undeservedly, the timbers are not so popular as those from the north. The reason for this is difficult to trace, for, in some instances, notably spotted gum, the timber is really superior in quality to that of the north, but it seems there is a fashion in timber as in other commodities, and the shortest way to account for it is by saying that at the present time South Coast timbers are not fashionable. The principal timbers obtained from the South Coast, and the market uses to which they are put, are indicated in the following table:—

Vernacular.	Botanical.	Colour of timber.	Principal characteristics.	Uses.
		HARDWOODS.		
Grey ironbark ..	Eucalyptus paniculata ..	Pale in some parts of this district to a medium red.	(Same as in the first table.)	
Narrow-leaved ironbark	„ crebra ...	Deep red ..	Heavy, strong, durable ..	Girders, beams, sleepers, and many other purposes, but not so extensively as E. paniculata.
Blackbutt	„ pilularis ..	(Same as the first table.)		
Spotted-gum ..	„ maculata ..	„	„	
Grey-box	„ hemiphloia ..	Pale brown ..	Tough, hard, cross-grained, non-fissile.	Piles, girders, sleepers, rail carriage frames, naves and cogs of wheels, mauls, handles, shafts, and poles
Forest red-gum ..	„ tereticornis ..	Deep red ..	Hard, heavy, durable, and inlocked grain.	Fence posts, naves, and felloes of wheels, general building purposes.
Sydney blue-gum	„ saligna ..	(Same as in first table)		
Woollybutt ..	„ longifolia ..	Dark red ..	Rather heavy, durable, and wavy grained.	Posts, wood-paving.
Bloodwood ..	„ corymbosa ..	Red	Heavy, durable, does not split with exposure.	Posts, culverts, paving, fencing, and ground works.
Turpentine ..	Syncarpia laurifolia ..	(Same as in first table.)		
		SOFT AND ORNAMENTAL WOODS.		
White beech ..	Gmelina Leichhardtii ..	(Same as in first table.)		
Beefwood	Stenocarpus saligna ..	Reddish ..	Fissile, durable, handsome.	Furniture, veneers, staves, gun-stocks, frames, and other ornamental purposes.
Blackwood ..	Acacia melanoxylon ..	Brownish ..	Hard, close-grained, and very ornamental.	Furniture, billiard-tables, cabinet work, frames, gun-stocks, walking-sticks, handles, interior railway carriage works, naves, and many other purposes.

Transport.

Few people in handling dressed timber, realise the difficulties of transit in the log it has undergone before passing through the mill, or know of the appliances in the shape of waggons, drays, trollies, trucks, jenkers, and punts that have been used to get it there. We have not yet reached that stage of advancement in this industry that will support railways specially for the transport of timber, and the few tramways that have penetrated back-country are of crude construction, and capable of contending only with the limited business of the individuals or companies who have projected them. Generally speaking, in reaching virgin forests of any extent, the class of country traversed is rough and difficult of access, and as these lands do not readily lend themselves to agricultural pursuits, a large number of persons, who would otherwise be unoccupied, find employment in the felling, transport, and working of timber. In some districts, in addition to land carriage, timber before shipment is brought long distances in punts. Illustrations of a typical forest (blackbutt), the method of loading logs, and a port of shipment are shown in Plate I. The difficulties of land transport are in some places exceptional, owing to the rugged character of the country, and absence of made roads; a large proportion of the land carriage is performed by bullock teams, and the tracks negotiated by them leading out of the forests, and before reaching main or made roads, are frequently very difficult. To see a team of bullocks toiling its way through the forest with a heavy log in tow is a sight not soon forgotten; the way impediments are overcome is almost incredible, and the cracking of Jehu's whip, accompanied by the crashing of small saplings, and the noise of breaking logs and groaning trucks can be heard long before the team is sighted. The bullock team largely makes its own road, and where a log of hardwood cannot be spare-chained or drawn out by bullocks, it had better remain, for no other method will repay its cost of removal. Plate II shows a typical river-side mill, and Plates III and IV give a fair illustration of logs *en route* and arriving at the mill behind bullock teams.

In some instances logs are brought in from the forest by tramways, the trucks on which are drawn by horses. The existence of a tramway indicates a mill in a large way of business, with cutting of a constant rather than spasmodic character. Some of these lines extend away back for distances of from 15 to 20 miles, and although as a first cost they are a tax on the business, the facilities of transport afforded in the long run pays handsomely for the outlay. An illustration of timber tramway with a group of tallow-wood logs at its terminus is shown in Plate V, and it may be mentioned, in reference to the uses of Brush-box given in the foregoing table, that the rails of this tram are laid down with that timber.

On reaching the mill, hardwood logs are usually put through at once; seasoning timber at this stage of the business is not considered payable, and, as a general rule, hardwood cuts with less wear on the

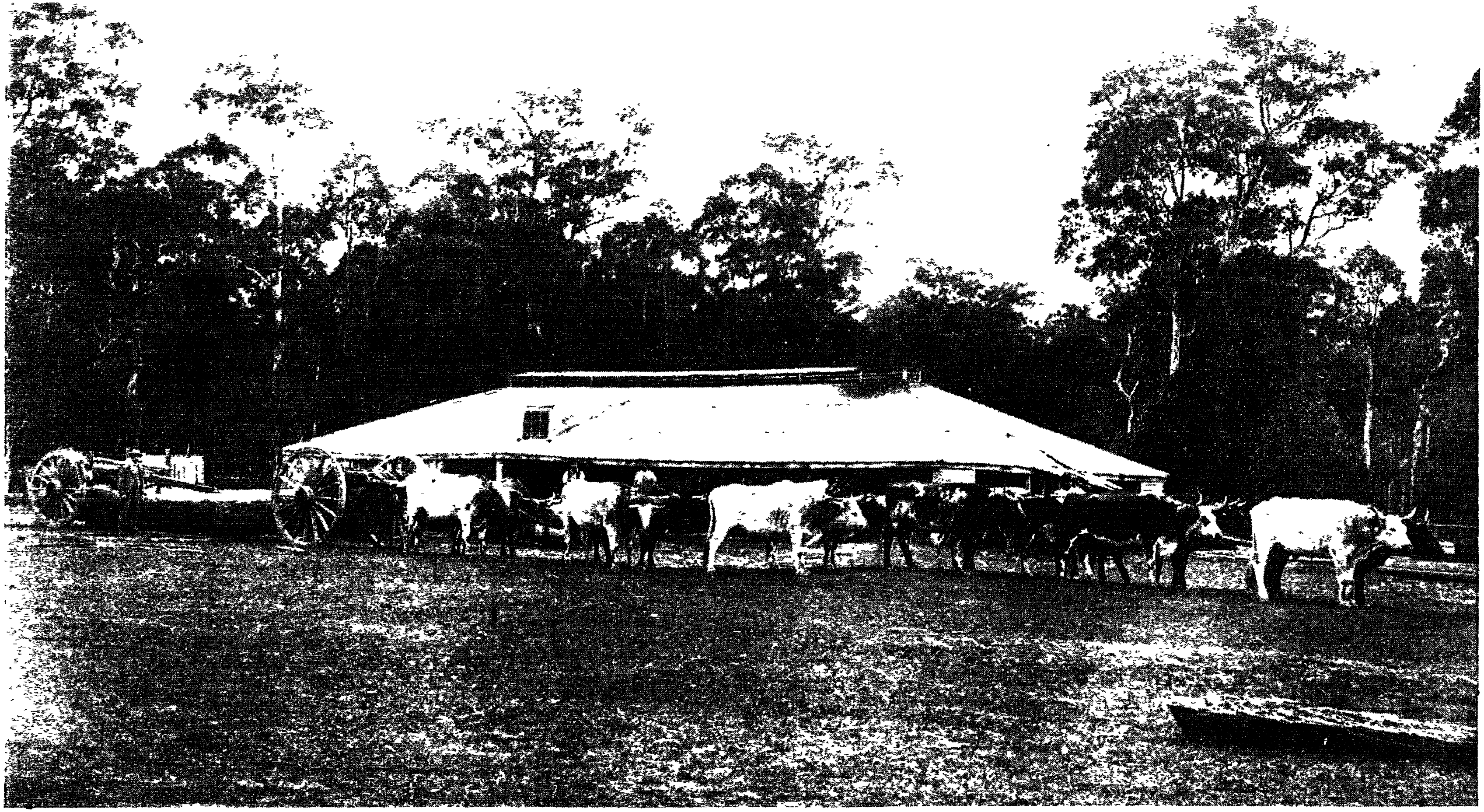


Plate III.—En Route.

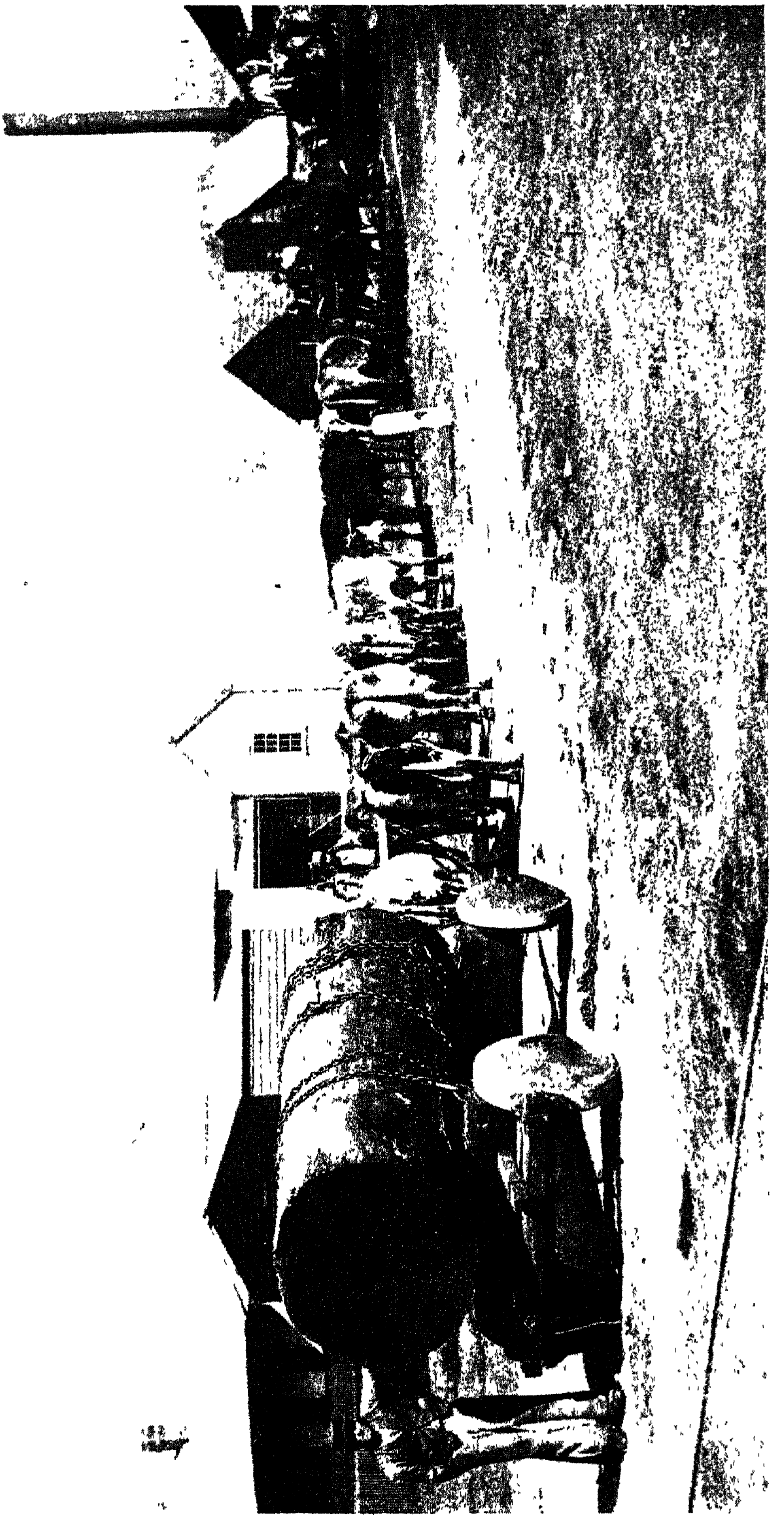


PLATE IV.—LOGS ARRIVING AT MILL.

saw when in a green state. The conversion into sizes, whether junks 6 in. x 6 in. and upwards, flitches, planks, palings, joists or studs, depends largely upon the order. In general milling the stock cuts are :—

Woodblocks ...	9 in. x 3 in. ; any lengths.
Scantling	3 in. x 2 in., 4 in. x $2\frac{1}{4}$ in., 4 in. x 3 in, 5 in. x 3 in., 6 in. x 3 in., 5 in. x $2\frac{1}{4}$ in., and 6 in. x $2\frac{1}{4}$ in. ; all lengths.
Flooring	4 in. x 1 in., 4 in. x $1\frac{1}{4}$ in., 5 in. x 1 in., 6 in. x 1 in., 6 in. x $1\frac{1}{4}$ in. ; all lengths.
Weatherboarding...	7 in. x $1\frac{1}{4}$ in., 8 in. x $1\frac{1}{4}$ in., 9 in. x $1\frac{7}{8}$ in. ; all lengths.

Some mills are engaged cutting special orders for export; for instance, woodblock 9 in. x 5 in. x 3 in. sizes in blackbutt, tallow-wood, and red mahogany, a recent order of 6,500 rail sleepers in 4 ft. 3 in. x 5 in. x $4\frac{3}{4}$ in., was executed in the North Coast from timbers of blue and grey gum, turpentine, and ironbark for Africa; and, amongst many other special orders too numerous to detail, may be set down 20,000 superficial feet of blackbutt for railway carriage works, London, cut in the same district, sizes $12\frac{1}{4}$ in. x $5\frac{1}{2}$ in., 12 in. x 5 in., 12 in. x $4\frac{1}{4}$ in., and $4\frac{1}{4}$ in. x $4\frac{1}{2}$ in. Spotted gum is being largely cut in the South Coast District to Victorian orders in special sizes for carriage, buggy, and wheelwright's work, and also for ship's planking, for which it is considered equal to English oak.

Illustration of fair types of coastal mills are those shown in Plates V and VI.

In felling and hewing timbers in the bush for piles, sleepers, and girders, there is a large trade in the coastal districts, and it may be set down as a fairly correct approximation that there are at least 300 persons employed solely in these businesses. Piles and girders are mostly cut from immature trees, the latter being squared to order. Piles of ironbark and turpentine run to 80-foot lengths, 60 feet being a fair average, and are marketable from lengths of about 30 feet. The stock sizes in girders, which are principally cut from ironbark, are 10 in. x 10 in., 12 in. x 10 in., 12 in. x 12 in., 14 in. x 12 in., 14 in. x 14 in., and 15 in. x 15 in., with lengths of from 12 to 80 feet. A large business in export of piles and girders to other colonies was done last year from the North Coast District, one firm alone shipping as much as $2\frac{1}{4}$ million superficial feet.

In softwood and ornamental timbers the trade is not extensive, and export next to nothing. Colonial pine is in fairly constant demand for flooring, lining, and box-making for the Sydney market, but it has a rival in the Baltic and other imported softwoods. The demand for red cedar is large, but the supply, owing to its growing scarcity, and the difficulties of haulage from localities in which it exists, is not plentiful. A demand is rising for rosewood, silky oak, and black bean, but as yet it has not assumed large proportions.

Before closing this portion of this article on the coastal trade, a word or two as to the forests in it from which the timbers are drawn may not be out of place. These may be roughly defined as open and

brush, containing in each mixed timbers. In the former are found the various hardwoods, and in the latter the soft and ornamental varieties, and usually no one variety predominates to so marked an extent as to enable its being defined as a forest of that variety, of course there are exceptions, and they are generally found in the cases of blackbutt and ironbark, which predominate over other species to a noticeable extent in certain tracts.

These forests are principally the property of the Crown, and are worked partly under license and partly under royalty systems; where timber is scattered, licenses at fees of from 5s. to 10s. per month apply, and where in larger quantities, or of superior quality, royalty which averages 6d. per 100 superficial feet on ironbark and tallow-wood, and 3d. per 100 superficial feet on other hardwoods is collected.

The Murray River District.

This, as far as the timber trade is concerned, extends from about Corowa for a distance of 150 miles down the Murray River to Barham and back from the river for distances of from 1 to 20 miles. The principal timber in this region is Eucalyptus rostrata, known to commerce as the Murray red-gum, and in some localities as river or flooded gum, the latter from its occurrence on the banks of rivers or in situations liable to inundation from the overflow of rivers in time of flood. In colour this timber is a pronounced red, its principal characteristics being its strength and durability. Amongst the hardwoods of this Colony there is perhaps no timber more valuable or more extensively used than Eucalyptus rostrata, it being in great demand for girders, sleepers, bridge building, piles, posts, fencing, underground mining works, wood-paving, and general building purposes. According to von Mueller, it is extensively employed by ship-builders for main stem, stern post, inner post, deadwood, floor timbers, futtocks, transoms, hause pieces, bottom planks, breast hooks and riders, windlass and bow rails. It requires steaming before it is worked for planking. It is also largely used for felloes, buffers, posts, and any parts of structure which come in contact with the ground. The principal market for this timber lies in the adjoining Colony of Victoria, it finding its way from this district in large quantities to Melbourne, and many other centres of population in the northern and north-western provinces of that Colony. It has not been to any extent exported, owing to the distance from a shipping port, and the increase to its cost occasioned by transport. According to the latest returns, there are eight mills in this district employing fifty-nine hands, 98 horse-power, plant to the value of £3,550, with a total annual output of 1¼ million superficial feet of timber; but this does not nearly represent the timber operations of this district, as there are five mills operating within it from the adjoining Colony, definite returns in connection with which are not available. As a rough estimate these latter employ another 150 hands and output about 3½

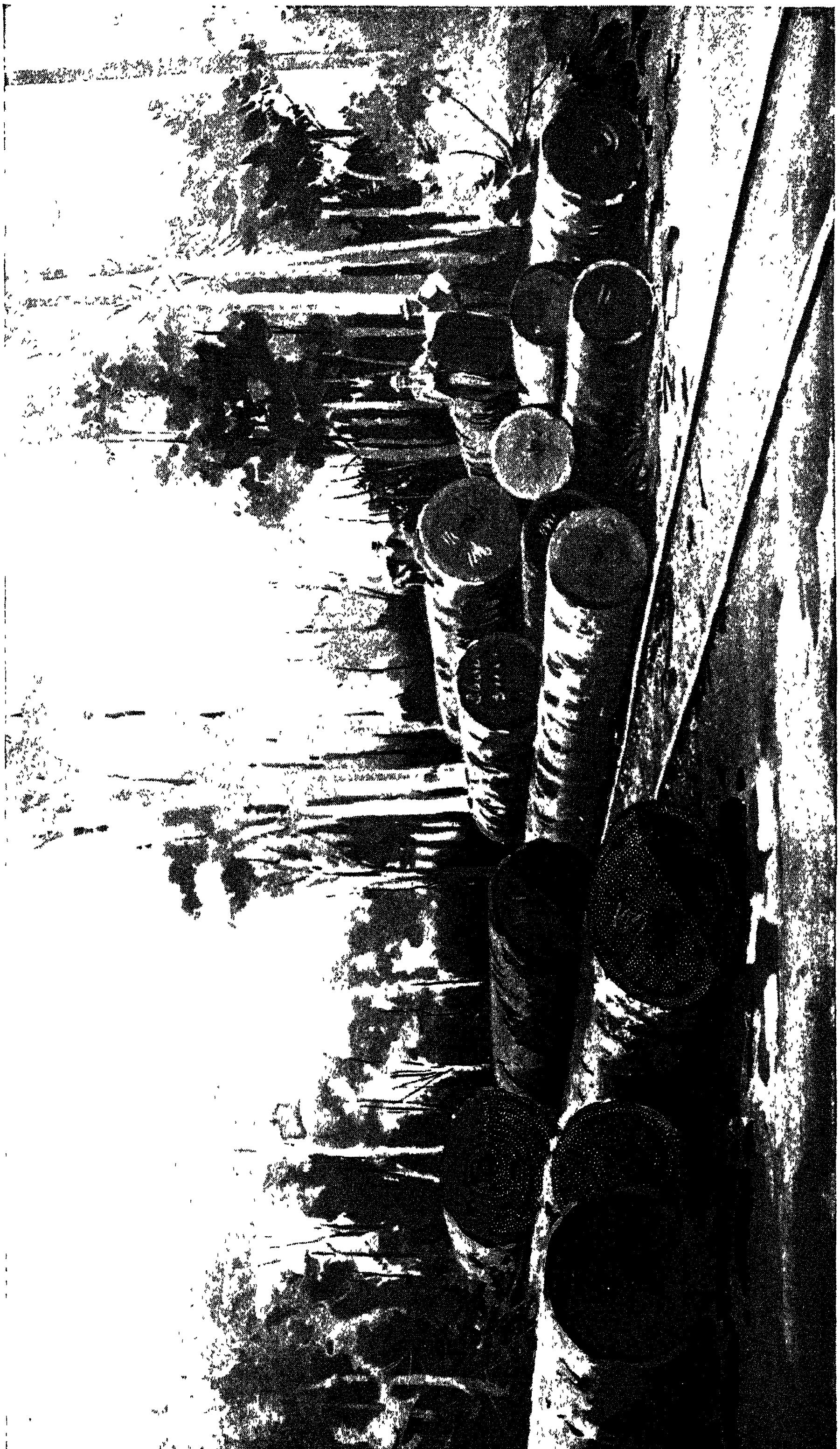


PLATE V.—A TIMBER TRAMWAY, WITH GROUP OF TALLOW-WOOD LOGS.

Plate VI.—A Murray River Red-gum Log.

millions superficial feet of timber, the gross output from all sources in this district would therefore be about $4\frac{3}{4}$ millions superficial feet of timber annually.

A brief description of this timber, the forests from which it is obtained and methods of working it, will not be without interest. It occurs principally in the flats of the Murray River, which, as before stated, are liable to inundation; this river overflows annually from the melting of snow on the high ranges near its sources, and the inundated forests are incapable of being worked to any extent for periods of from four to six months in the year.

Fellings for the mills are therefore made largely in advance, and the timber drawn by teams to depôts on high lands or points on the river above flood-level, from which it can readily be removed by punts, barges, or trollies. Almost the whole of these forests in extent some 400 square miles are the property of the Crown, and are worked by a system of royalty under which miller's pay at the rate of 12s. 6d. per 1,000 superficial feet of timber (log measurement) for fully matured trees, and at special rates per running foot for undersized trees required for piles and girders before removal from the forests or depôts; the rates for immature trees being more restrictive than for matured, so as to discourage their felling.

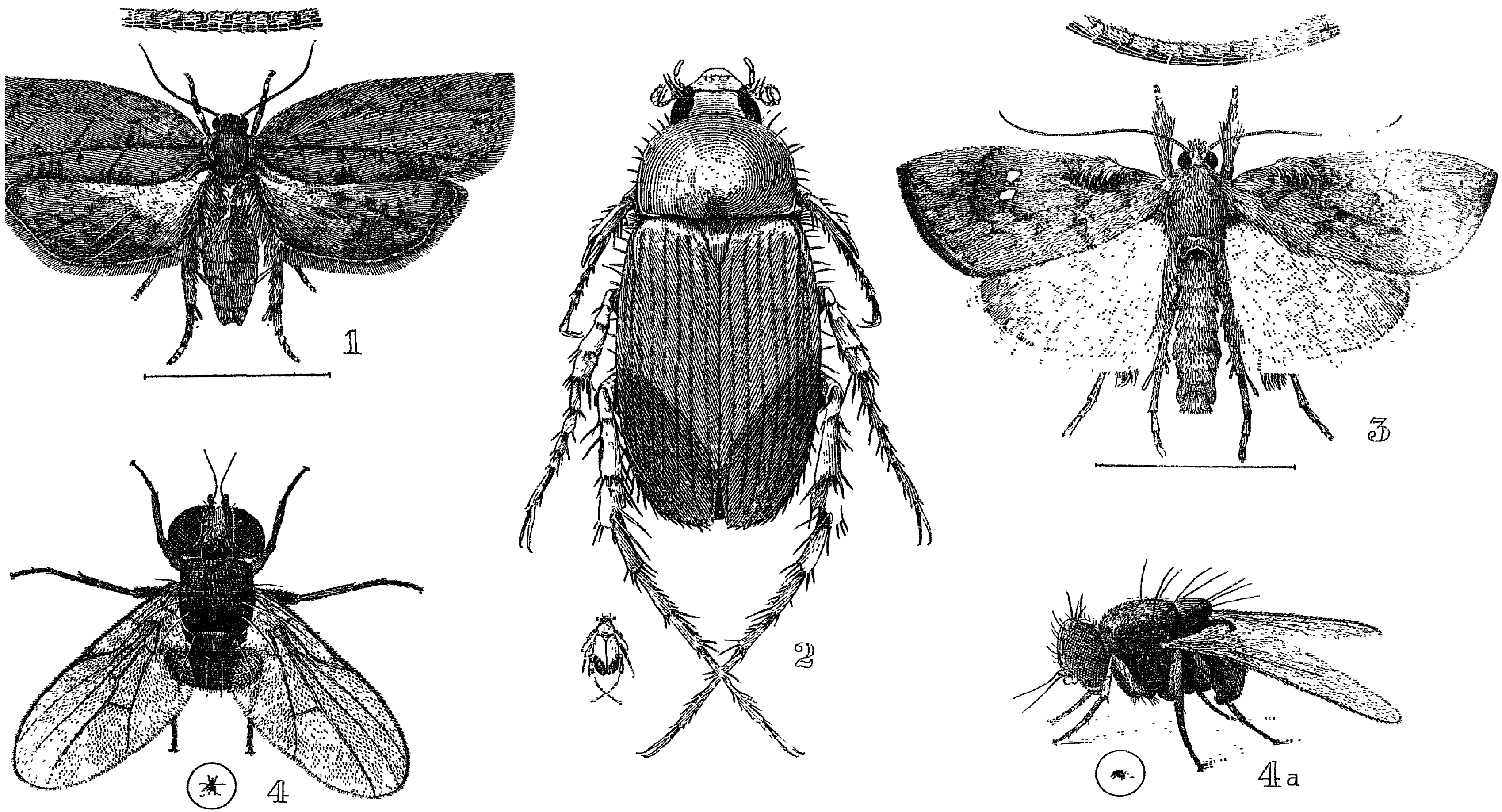
The felling girth, according to State regulations, is 7 ft. 6 in., and over, measured at 5 feet from the ground, the tree is a rapid grower in moist situations, and although usually short in the barrel reaches at times stem girths up to 15 feet; lengths up to 50 and 60 feet can be obtained for piles and girders where it has grown close and attained an upright habit.

An exceptionally fine specimen of a red-gum log on its way to the mill which contains about 6,000 superficial feet of timber, is shown in the accompanying plate (VI); and it may be judged from the width of wheels on the trollies that haulage over this country, which is liable to inundation, is very heavy.

In conclusion to the whole article, the following summary of the results of tests of New South Wales timber, conducted by W. H. Warren, Esq., Professor of Engineering, Sydney University, is appended.

SUMMARY of the Results of Testing New South Wales Timbers, giving the average values for each kind of Timber.

Local Name.	Number and Letter.	Weight per cubic foot in lb.	Tension Tests.		Compression Tests. Ratio of length of column to smallest dimensions.								Bending Tests.		Shearing Tests.
					21 to 1.		16 to 1.		8 to 1.		4 to 1.				
			Breaking stress in lb. per square inch.	Modulus of elasticity in lb. per square in.	Breaking stress in lb. per square in.	Modulus of elasticity in lb. per square in.	Breaking stress in lb. per square in.	Modulus of elasticity in lb. per square in.	Breaking stress in lb. per square in.	Modulus of elasticity in lb. per square in.	Breaking stress in lb. per square in.	Modulus of elasticity in lb. per square in.	Modulus of rupture in lb. per square in.	Modulus of elasticity in lb. per square in.	Breaking stress in lb. per square in. along the grain.
Tallow-wood	F 3	77·06	16,105	2,274,790	6,943	2,222,298	7,721	2,163,360	6,373	1,618,803	7,585	1,663,201	15,257	2,287,532	1,802
Spotted gum	B 3	62·19	14,413	4,383,483	5,499	2,793,579	6,456	2,027,980	6,561	2,028,058	6,753	1,820,432	13,296	2,056,101	1,583
Blackbutt	B 4 / F 1	66·69	21,708	3,105,979	6,572	2,343,485	7,756	2,649,063	7,526	1,775,249	7,522	1,734,698	13,728	2,162,764	1,757
Swamp mahogany ..	B 6	75·98	16,520	....	5,263	2,524,987	6,113	2,559,386	6,569	1,796,229	6,846	2,494,505	12,124	2,098,701	1,166
Grey ironbark	B 1	73·85	25,080	5,526,400	8,112	3,074,679	9,482	3,354,236	9,112	3,500,000	10,165	....	17,866	2,484,799	2,187
Red ironbark	B 2	76·52	19,609	....	7,701	2,770,985	8,760	3,254,172	9,403	1,770,556	9,281	1,879,734	16,275	2,341,802	2,012
White ironbark.. ..	D 1	73·55	9,861	....	6,923	2,459,460	9,103	2,747,521	8,225	1,938,865	8,680	1,612,544	16,932	2,794,020	1,974
Woollybutt	B 5	63·89	19,968	4,495,266	5,542	2,605,892	6,121	2,303,768	7,074	1,935,845	6,981	1,314,657	12,708	2,140,443	1,729
Red gum..	3 M	62·19	8,884	1,292,691	3,370	987,364	5,655	1,498,591	4,651	1,381,447	5,016	581,601	6,930	761,769	2,122
Grey gum	F 4	57·33	20,821	5,010,372	6,492	2,308,678	7,006	2,035,821	7,452	1,753,612	7,243	1,780,029	13,092	2,146,733	1,503
Flooded gum ..	F 5	77·94	14,887	3,761,988	7,494	2,483,221	8,889	2,179,183	8,700	2,055,027	8,761	1,779,584	17,622	2,341,430	1,976
	A 3	69·34	16,952	2,507,263	5,566	1,854,580	5,786	1,837,792	5,905	1,341,473	5,889	1,333,385	12,023	1,943,398	1,559
Mountain ash	B 7	66 57	18,974	2,902,000	5,197	1,962,851	4,903	1,575,852	6,324	1,590,076	5,959	1,359,651	11,527	2,054,227	1,812
Blackwood	B 8	70·58	14,883	2,104,400	6,189	1,814,563	7,006	1,929,960	7,100	1,791,961	6,784	1,580,199	10,264	1,908,432	2,033
Grey box..	D 2	73·62	22,415	2,547,100	7,210	2,606,847	8,031	2,594,558	8,525	2,344,415	8,021	1,753,462	16,209	2,766,435	1,791
Pine	D 3	54·31	15,901	3,263,000	4,489	1,922,626	....	....	4,530	1,258,870	4,199	1,181,619	8,824	2,408,267	1,222
Forest mahogany ..	D 4	72·23	14,115	2,315,400	5,106	2,025,073	6,329	2,095,276	5,386	1,124,000	7,967	1,879,257	13,769	3,040,883	1,607
Rosewood	D 5	74·29	13,578	2,268,750	5,271	1,965,086	5,593	1,773,963	5,371	1,202,261	6,011	1,144,837	10,594	1,937,474	1,722
White beech	D 6	63·03	9,934	2,794,750	6,276	2,072,272	6,858	1,736,143	7,241	1,458,828	8,253	1,229,278	15,607	2,421,119	2,066
Mahogany	F 2	75·06	19,753	3,741,376	7,699	2,451,424	7,902	2,138,100	9,061	2,059,898	7,514	1,588,160	14,500	2,258,372	2,109
Forest oak ..	A 0 / A 1	75·48	17,107 / 13,245	4,470,909 / 2,207,505	7,270	2,117,461	8,375	2,187,550	8,139	1,742,492	8,335	2,126,210	15,492	2,396,263	1,388
Turpentine	A 2	69·34	16,821	4,077,377	4,917	1,813,631	5,882	1,675,220	5,810	1,332,621	6,364	1,544,477	11,727	1,965,524	1,451
Stringybark	A 4	71·33	19,399	2,761,812	5,685	2,128,870	5,565	1,810,923	6,575	1,790,161	5,985	1,234,109	13,931	2,353,044	1,942
Australian teak.. ..	F 6	62· 9	....	....	5,648	2,236,857	5,574	2,210,227	6,502	1,883,243	7,030	1,735,887	14,415	2,174,875	1,397



SOME COMMON PESTS.

Entomological Notes for 1898.

WALTER W. FROGGATT,
Government Entomologist.

DURING the last year the number of entomological specimens forwarded to the Department has steadily increased in number and value in comparison with previous years; and the writer hopes that this will still continue, and that every year will see greater advantage taken of the special knowledge which is always at the service of our country correspondents.

The country is full of wonderful little creatures. Every tree and even weed is the food-plant or resting-place of scores of insects, many of them too small to be seen with the naked eye, yet under the microscope these tiny mites show more remarkable structure than many of the larger insects. Nothing is common, dirty, or disgusting in natural history, for every organism, from the maggot in the carrion to the beautiful golden-winged butterfly, has its use in the great plan of the Universe; and it is generally our own fault, either in destroying the natural food-plants of our native insects or shooting the busy little insectivorous birds, that we alter their natural surroundings and force them to come upon our cultivated plants and trees.

If the dwellers in the country who have so many wonderful creatures around their homes could be persuaded to take a little interest in their habits and development, they would soon accumulate a surprising amount of information that would be both useful and entertaining. If an orchardist knows the life-history of a destructive pest he can deal with it in its early stages of growth, while his neighbour will let it overrun the place. Many an idle moment could be profitably employed in this manner, and the Entomologist is only too glad to answer questions and receive any specimens found either in the bush or garden. A bush naturalist who interests his neighbours in the study of Nature in his district (and there are increasing numbers among my correspondents) can do most useful work to all around him.

The Honey Beetle (*Phyllotocus Macleayi*, Fischer).

[Plate I, Fig. 2.]

This is a very common little lamellicorn beetle, in the early summer months haunting the flowers of many of our bush trees, such as the *Angophora* and *Leptospermum*, and sucking out the honey. When collecting insects among the bushes, you can shake down thousands of this and several other species, and they are not uncommon amongst the flowers in our gardens later on in the season.

This beetle measures about one-third of an inch in length, with the hind legs much longer than the front ones; its general colour is yellowish-brown, with the hind portion of the wing-covers marked with a large oval black patch, broadest at the back; the thorax and

body are arched, forming a convex surface above the wing covers, finely striated; the under surface and legs covered with short hairs, somewhat spiny on the legs.

We know nothing about the life-history of this group of beetles, but probably, like most of the lamellicorn beetle larvæ, they pass their earlier stages of existence in the soil or decaying vegetable matter.

On the 6th of last January, Mr. W. Reed, of Pumpong, Cooma, sent a box full of these beetles, with the following information. He says: "These beetles have been storming our beehives, appearing immediately after sundown for the last four days, and they arrived last summer in exactly the same manner, and on the same date. They simply walk into the hives, enter the cells in the honeycomb, and help themselves. The only chance that the bees have to save their stores is to seize hold of the beetles and carry them out bodily. We destroyed 9 quarts of these beetles in three nights by placing tubs containing water sweetened with honey among the beehives."

This is a remarkable instance of the change of habit in a flower-hunting beetle, which has evidently discovered that it is easier to let the bees collect the honey than to hunt for it themselves.

Fig-leaf Beetle (*Galleruca semipullata*, Clk.)

Specimens of this destructive beetle were received from the Town Clerk at Rockdale, accompanied with the information that they were spoiling the foliage of the Moreton Bay fig-trees planted along the streets of that municipality. Although the larvæ of this chrysomalid beetle are well known in our gardens upon cultured figs, frequently skeletonising scores of leaves, and thus causing them to curl up and fall of, this is the first instance on which it has been recorded as attacking the Moreton Bay fig *(Ficus macrophylla.)*

In their native state they feed chiefly upon the rough-leaved native fig-trees *(F. scabra)* about Sydney; but as they have a wide distribution over the greater part of Australia, these beetles probably have other allied food-plants.

The beetles lay their slender yellow eggs in clusters on the under surface of the leaf, attached by the base, from which the young grubs emerge early in the summer and commence feeding in a social group. At first they are pale yellow, but become darker, and though clustering together when small, move about freely as they reach maturity. About the fourteenth day after leaving the eggs they are almost black, measure about half an inch in length, and are ready to pupate. They generally bury themselves in the soil beneath the tree, head downwards, with the tip of the abdomen projecting above the soil, but sometimes simply rest on the ground lightly covered with rubbish. In this state they are pale yellow, with the head, wing covers, and legs well defined. Within a fortnight they begin to emerge as the perfect beetle.

The beetle is slightly under half an inch in length, of a general dull yellow-brown; antennæ, eyes and legs, black; the head and thorax lighter than the wing covers.

Parasites.

The active little plant bug *(Arma sibellanbergi)* described in Entomological Notes, 1897, as destroying the larvæ of the common day vine moth, has also turned its attention to this grub, and on several occasions I have found them clearing the figs of these grubs in an astonishingly rapid manner. These larvæ do not seem to have any hymenopterous or dipterous parasites, like so many other defenceless larvæ, but probably many of the chrysalids must be destroyed by night-feeding carab-beetles when on the ground.

Remedies.—Like all surface-eating insects, these are easily eradicated by spraying with Paris green, 1 oz. to 16 gallons of water. Dry lime or Paris green will also kill every one it comes in contact with, and it is only when they are neglected that they do much damage.

Thrips (*Sp. ?*).

Towards the end of last June Mr. J. O'Hara, manager of the Palmdale Orchard, Ourimbah, sent a number of persimmons that were all discoloured with brown spots, which he stated were caused by insects.

These persimmons had been placed in the fruit-room in a perfectly clean state, but upon examination some weeks later were found to be all mottled in this peculiar manner. Careful examination showed that colonies of these little insects were breeding under the rough calyx (stalk leaves) round the stalk, and coming out from this shelter were feeding upon the coarse skin of the fruit, discolouring them so badly that they were unfit for market.

Many different species of Thrips (popularly known as Black Fly) attack the foliage of plants, eating the epidermis, and often killing the leaves; but I do not know of any Australian species that has been noticed damaging fruit.

The adult insects are slender creatures of a general black colour, and not more than the eighth of an inch in length; they are remarkable for having long slender wings folded down the centre of the back, the edges of which are beautifully feathered on both sides.

Remedies.—Where the fruit is gathered and in a shed, it could be easily fumigated with hydrocyanic gas or bisulphide of carbon. If the fruit were attacked before being gathered, a spray with kerosene emulsion would soon destroy the Thrips.

French Bean Fly (*Agromyza phaseoli*, Coquillet).

[Plate I, Figs. 4 and 4a.]

Last April both Mr. F. Ruff, of Wamberal, and Mr. W. E. Denings, of Erina, forwarded specimens of diseased bean-plants from the Gosford district, stating that a small fly was destroying all their early crops. I visited Mr. Denings and found that about 5 acres of French beans, that were from 6 inches to a foot above the ground and otherwise well grown, were so badly infested that he did not expect to save a plant. Upon examination, the stem of each plant was found to contain a number of small maggots and chrysalids; the eggs had evidently been deposited by the fly at the level of the ground, and

when hatched some of the grubs had tunnelled along under the skin towards the roots, while others had travelled upwards leaving the stem rusty-red and cracked.

The perfect fly is a small black creature 1 line in length, with the eyes dark-red, the thorax smooth and shining, the wings clear with black nervures, the whole insect thickly covered with coarse hairs thickest round the head and sides of the thorax. A technical description of this fly will appear on the proceedings of the Linnean Society, by Mr. D. W. Coquillet from specimens forwarded by me.

Remedies.—I could see no means of ridding the garden of this pest except the drastic one of pulling up every plant and burning it, as the flies were there in millions. Mr. Denings acted on my advice and made a clean sweep, with the result that this year he tells me that up to the present he has not seen any flies.

Light-brown Apple Moth (*Cacœcia postvittana*, Walk).

[Plate I, Fig. 1.]

Late last season a number of oranges were sent in from near Galston attacked by a maggot or grub which bored through the rind and fed upon the white pithy portion of the skin, and though not attacking the fleshy part, still causing the orange to decay through the damage done to the skin.

The grub was of a dull-green colour, lighter on the under surface, with a yellowish-green head, short and thick in proportion to its length which is about half-an-inch when full grown.

The larva pupated among some orange-skins upon which it was feeding, and emerged some three weeks later.

This pest belongs to a genus of well-known Australian moths of which *Mr. Meyrick, describes twenty-one species, some of which are peculiar to New Zealand, while others have a wide range over all the colonies. In its native state, Mr. Meyrick says, the larva feeds among the rolled up leaves of a number of different native shrubs and is not at all particular about its food. He gives a technical description of this species, and says that it has a very wide range over New South Wales, Tasmania, and Victoria.

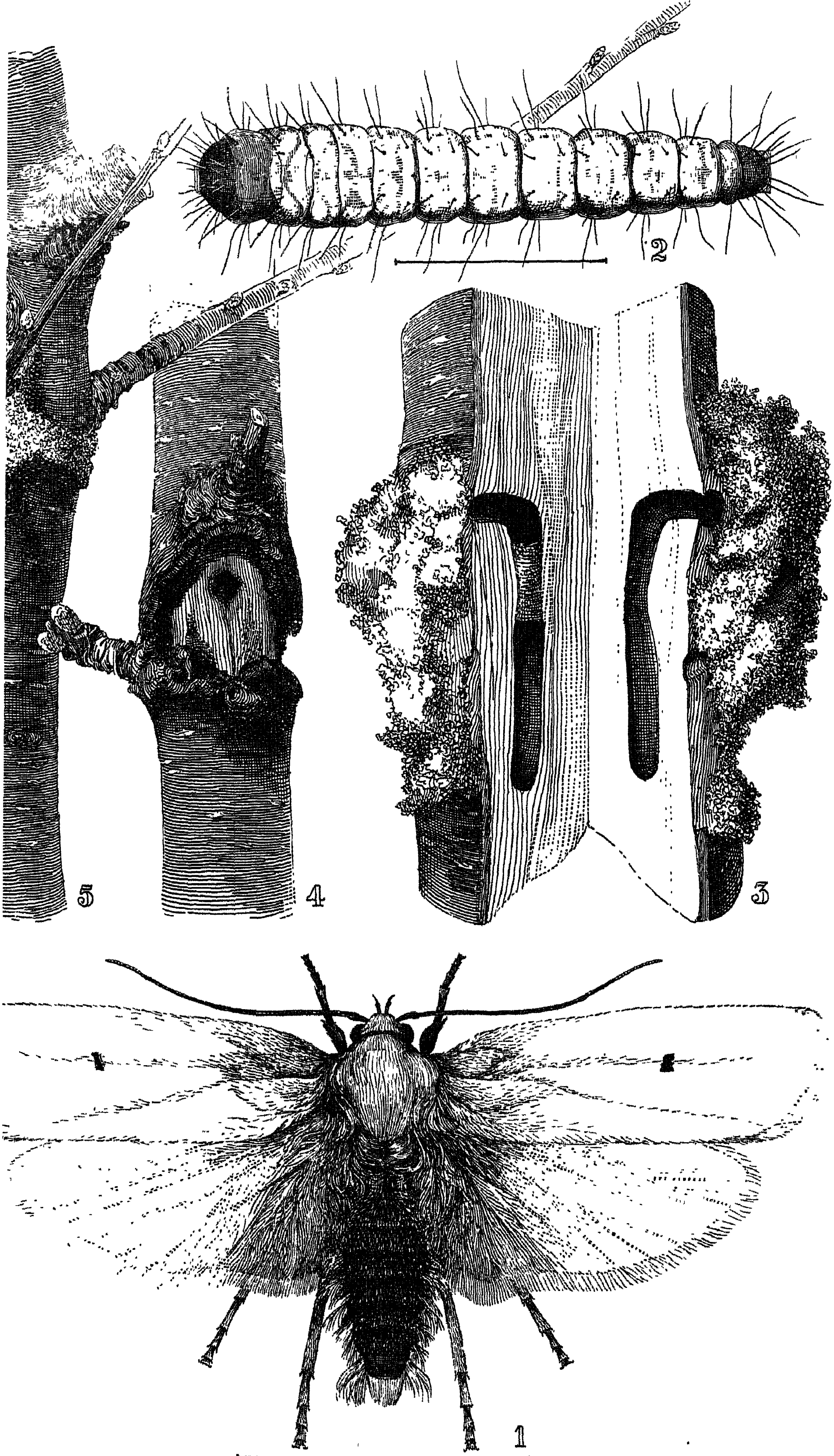
†In Mr. Olliff's account of the "Codlin Moth," he mentions this as another apple-tree pest, having received specimens from Victoria where it attacked apples in a similar manner to the codlin moth.

In "Insect and fungus pests attacking pear-trees in South Australia," Crawford describes a species, which is probably this one, as a pest.

In French's Handbook of Destructive Insects, Pt. I, he describes and figures a species under the name of *Cacœcia responsana*) "the light-brown apple moth," which the late Mr. Olliff, who saw the specimen, told me is this species.

The moth varies from 10 lines to 1 inch across the out-spread wings, and is of a general light reddish-brown with a silvery sheen upon its

* Pro. Linn. Soc. N.S.W., 1881, p. 504.
† *Agri. Gazette*, N.S.W., Vol. I, 1890, p. 3.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5
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wings. The head small, eyes large, projecting palpi, and long slender antennæ; the thorax and body proportionately stout; fore wings curving in at the shoulders, straight along the front margin, and round at the tips, light reddish-brown mottled towards the tips with darker brown scales; hind wings of a more brownish tint, thickly fringed with fine scales. The legs long, covered with silvery scales. Under surface of fore-wings mottled with darker brown, hind pair irregularly spotted with a similar colour.

It is remarkable that we have no record of this moth attacking apples in this Colony, but that instead it should now turn up as an orange pest.

Remedies.—Look after and destroy all oranges that show a hole and damaged space, as big as a two shilling piece, round it. Where it attacks apples the spraying with Paris green would check it in the same manner as codlin moth.

The Cherry-tree Borer (*Cryptophaga unipunctata*, Don.).

[Plate II.]

During a visit to Bathurst last year I found that the larva of one of these borers was doing a great deal of damage to the shade trees planted in the streets, especially the cork elms, and willows, and on examining them found that the caterpillar of this moth was the culprit. The caretaker at the gardens informed me that he had lost several fine willow-trees from their attacks the year before, and judging from the ravages they had committed among the street trees a number of them would die, if not taken in time.

Their method of attack was somewhat different from the regular way in which the young grub proceeds to work on a cherry-tree, where it forms a regular burrow through the sapwood about an inch in depth, and after covering it with a thick felted silk web, gnaws a ring clean round also covered with a web; this often causes the branch to die, and when a number of eggs have been deposited, and unnoticed, the tree soon becomes seriously damaged.

Upon these shade trees (doubtless on account of the roughness of the bark) the young grubs gnawed a considerable patch of bark under which they fed, and also big holes into the sapwood, particularly upon the soft-wooded willows, and when these burrows met, and a whole area became damaged, the tree was in a bad way.

In its native state this species feeds chiefly upon the common honeysuckle (*Banksia serrata*), generally making its tunnel in the fork between two branches of the old trees, and in the upright limbs of the young ones. The grubs feed upon the bark, but also emerge at night, and cutting off the leaves drag them down, and pulling them through the web in front of the chamber, nibble them at leisure. Some of the other species of this genus that infest the different wattles will often strip all the leaves off for a considerable distance round their chamber, and leave the ends dangling down in a bunch in front of the entrance to their hiding place.

The caterpillar, when full grown, turns into a reddish-brown chrysalid, and pupates in the chamber.

Description.—The caterpillar, when full grown, measures about $1\frac{1}{2}$ inches in length, is of a general dull reddish brown colour, smooth and naked, with the exception of a few scattered hairs along the sides of the segments. The head is rather large, of a dark rusty-red colour, the undersurface pale yellow, legs small, reddish brown, with two claspers on 3, 4, 5, and 6th abdominal segments, and the anal tip of the body produced into a pair of stout claspers.

The Moth.—Measures slightly over $1\frac{1}{2}$ inches across the outspread wings; the antennæ, palpi, eyes, and forelegs black, the head, thorax, and wings of a beautiful white-satiny colour, with a single tiny black spot in the centre of the fore-wings, the upper surface of the abdomen black fringed, and marked with rich orange-yellow down, forming a thick tuft at the extremity; the median and hind legs are armed with stout black spines on the base of the tibiæ, with another one in the centre of the tibiæ of the hind pair, and are thickly clothed with rich orange-yellow down to the tarsi.

Remedies.—If, when the web is first noticed round the hole, a stick is taken and it is cleaned away, it is generally easy enough to kill the young larvæ before they work their way into the trunk. If, however, they have been allowed to work unnoticed until they have formed their chamber into the trunk, they are not so easy to destroy, for at the least alarm they retreat to the bottom of their gallery.

I have observed that early in the morning they are always just behind the web, which, if torn off quickly, exposes them before they can scurry downwards.

A piece of copper-wire is the best thing to poke down their tunnels, and a very slight scratch will cause the grub to die. An application of a little kerosene or soap over each hole will also act effectively, and also deter the moths from depositing their eggs on the bark.*

The Horse-radish Moth (*Godara comalis*, Guer.).

[Plate I, Fig. 3.]

This is not uncommon in gardens about Sydney in the winter months, where horse-radish is growing in sheltered corners, and if unchecked the multitude of little caterpillars will soon strip the softer tissue of the foliage, leaving nothing but the mid-rib and coarser parts of the leaves attacked. They cluster along the centre of the leaf, working from beneath, lightly covering themselves with silken strands, so that they are well protected when feeding.

Caterpillar (1st stage), yellowish-green with the front of the head yellow, the hind-half green; a transverse bar of pale canary-yellow crossing the hind edge of each segment with a stripe of the same colour running along each side, the whole caterpillar lightly clothed with long light-brown hairs.

* In the "Proceedings of the Linnean Society of N.S.W.," vol. 5, 1890, Henry Edwards gives an account of the damage caused by these larvæ in some of the Melbourne gardens, and describes their habits and metamorphosis. He says their native food-plant is the black wattle (*Acacia decurrens*), but their habits are somewhat variable when feeding upon different trees. Mr. French describes this species in his book on insect pests under the old name of *Maroya gigantella*.

Caterpillar (full-grown). Half-an-inch in length, slender in form, with the head light brown, rounded on either side, truncate behind; general colour, light green, with three slender stripes of lighter colour running from behind the head to the base of the anal segment, the first occupying the centre of the back with one along either side. The first thoracic segment thickly blotched with black; the second and third with two black spots on either side, but all the abdominal segments with three black spots on either side; the anal segment with a rounded dark-coloured projection at the base, and a slight spot on either side of the tip, which is turned downward and divided into two stout claspers. The under-surface of the caterpillar is pale green, with the legs and claspers semi-transparent at the base, with the extremities brownish; lightly clothed on the upper surface with long hairs, thickest along the sides.

The caterpillar, when full grown, forms a loose silken cocoon, in which it pupates, coming out in the early summer.

The moth measures an inch across the outspread wings, with the body rather slender; the head small, but broad in proportion; eyes large, dark brown; antennæ long, slender, filiform, with the projecting palpi grey. The thorax is light brown, with a curious raised tuft of slender scales, tipped with brown, standing erect at the apex of the thorax; the body covered with silvery pale-brown scales. The fore wings slender, straight along the front margin for about two-thirds, then curving round, rounded at the tips, silvery grey, but so thickly mottled with reddish-brown scales so that they assume a darker tint. These scales form a dark mark on the front margin, an irregular parallel line through the centre, and cloud the edge of the extremity of the wings. Two white opaline spots occupy the centre of the wing, and a number of black dots form an indistinct pattern beyond them, and an irregular row along the other margins.

The hind wings are light brown, silvery, clouded, and somewhat darker towards the extremities. The markings upon the fore wings vary considerably in a series of specimens, some being very lightly spotted.

Remedies.—Cut off and destroy all infested leaves as soon as they are noticed.

Western Agriculture.

R. W. PEACOCK.

Narramine District.

EVEN the casual observer travelling along the Western line could not fail to notice the large quantities of agricultural implements at many of the Western railway stations, and at no place are the signs of progressive agriculture more apparent than at Narramine.

This district has proved to be admirably adapted to wheat culture, possessing the advantages of a fairly rich red loam and an average rainfall of about 20½ inches.

After the necessary experiments in wheat-growing, the landholders found that their profits could be materially augmented by putting large areas under crop, not only to produce grain, but also hay, to tide them over the droughts, which were not unknown in the locality. The advantages of combined sheep-farming and agriculture are fully recognised, and the profitable growth of lucerne on the red loam has been fully demonstrated by Mr. Mack, whose property adjoins the railway.

Although last season was anything but a good one in the district for grazing, the rainfall came at the desired time for the crops, resulting in a profitable yield, with sufficient hay and straw for local consumption as well as a large surplus, which has been forwarded further west for the starving stock of the less fortunate interior.

The various operations, such as fencing, clearing, and ploughing, point to a still larger area being put under cultivation this season. A short account of Mr. Robt. Webbs' holding, a few miles east of Narramine, will give a better idea of the rapid agricultural expansion of the district. Upon this holding about 2,800 acres of wheat will be sown this year, 700 acres of which are farmed by the owner, 1,400 on the halves system, and 700 more are leased to tenants. Mr. Webb hopes to have in all 4,000 acres under crop next season; and to meet the exigencies of the people on the estate, the Railway Commissioners are to be approached for a platform at the siding. There are eleven families on the place.

The soil is pre-eminently a wheat soil; as high as 40 bushels to the acre have been grown. During one season the average was 32 bushels; the average yield last year was 18½ bushels, the best portion stripping eight bags, the varieties of wheat most in favour being Steinwedel, Hudson's Purple Straw, Chants' Prolific, and Allora Spring; also, Manitoba is being experimented with. Mr. Webb is a firm believer in early and light sowing, considering half a bushel sufficient if sown in March, and three-quarters for later sowings. The advantages of light sowing were very marked with him last season, as also were the

effects of harrowing after the crop had covered the ground—so much so that he intends going over all his land again this year, and if possible twice. I was pleased with the numerous inquiries from the many farmers I met, and also with the fact that Mr. Thompson's (Travelling Instructor) lectures had been appreciated, and his advice was being followed by many of them. At the time of my visit (the middle of June), the wheat in many paddocks had well covered the ground, and at one farm on the halves-system a portion of the early-sown crop was 8 or 9 inches in height, which was due to the land having been ploughed early in the summer, and the seed ploughed under to the depth of 3 inches at sowing time. So apparent was the effect of the extra ploughing over the other portion sown in the same manner and at the same time, that the owner is an ardent champion of better cultivation, alleging that by so doing germination is ensured, which would be impossible in such seasons as the present by the more commonly pursued methods.

From time to time the principles here touched upon have been advocated by the officers of the Department, and it is pleasing to know that they are commending themselves to the farmer by such practical illustrations as above enumerated. It is sincerely to be hoped that fortune will smile again during this coming season upon the pioneers who have done so much for the development of the agricultural industry in the west.

Edible Trees and Shrubs.

I cannot allow the present opportunity to pass without entering a protest against the undesirable destruction of the valuable trees and shrubs which have been the mainstay upon most of the stations of the Western district for the last six months. That the best of the trees upon too many of the holdings have been cut down, thus giving them no opportunity to recover is painfully evident. I have noticed hundreds of Kurrajongs felled which should have been lopped; and also "Supple-jacks" burnt down, instead of being decently treated, on account of the hardness of the timber.

That this policy is suicidal should be self-evident; and many thousands of acres comprising edible trees will be useless for similar purposes for many years to come. It is not a pleasant task to have to record such facts, but in the interest of future settlers publicity should be given to them. It is pleasing to notice on some runs that the trees have all been properly lopped, whereas upon some others the reverse obtains. That the landholders have laboured under very adverse conditions will not be disputed, one of the principal being the inability to obtain sufficient men to cut scrub for their stock; and in some cases many thousands of sheep have died from this cause. The proper treatment of these trees would entail an extra outlay in labour of probably 20 per cent. That such would be well expended will be more evident when the next drought makes its appearance.

Most of the trees are apt to perish if denuded of all their foliage, which acts as lungs, and some limbs should always be left upon them. The Kurrajong sprouts more readily than any, whereas the Mulga and

Myall invariably die if lopped too severely. The limbs of the Mulga if only chopped upon the upper side often fall without becoming detached from the tree, and continue to send out leaves for the stock. I have heard some people maintain that a proper system of lopping cannot be carried out, but there are too many good object-lessons upon systematic lopping, by the provident settler, who is interested sufficiently in his run to take the trouble to do the thing thoroughly, and many sheep have been saved by the suckers following upon the judicious lopping in former droughts. And not only are the suckers a valuable standby, but they have a greater feeding value than older timber, in not being so woody. From my observations and inquiries in this district, I find that the greatest evil lies in the sheep not getting sufficient leaves, they being forced to eat too much timber, a fact which is borne out by Mr. Robertson's article in the June *Gazette*. Some of the sheep here have improved during the last few months, but the scrub has not been spared, and injurious varieties left out of their diet. On many runs a choice is not possible.

I would like to draw the attention of readers of the *Gazette* to a vine (*Lyonsia eucalyptifolia*) which is very abundant here. It grows upon the trees to a considerable height, and has when in flower a very strong perfume. The flowers are of a yellowish colour, growing in clusters. Sheep are very fond of it, and eat it greedily even when there is a fair amount of grass. It is considered by many to be an excellent sheep-fodder, one lessee considering it so until the other day, when he concluded that it very injuriously affected his sheep, to which he had given more than the ordinary quantity. Many of the sheep went quite stupid, and about a dozen died. Everything pointed to this vine being the cause; but it would not be wise to condemn it upon insufficient evidence. I would be pleased to learn of the experiences of others with it. The difficulty of giving sufficient information whereby these plants may be recognised by all is a serious one, and it is to be hoped that projected arrangements to have the standing trees photographed and illustrated for more easy recognition will soon be carried out. It would aid very materially the gathering of reliable information regarding the values of the various fodder plants.

[Material for this purpose is now being collected, and it is hoped that very shortly it will be possible to issue a small handbook describing and illustrating the standing plants and special features of all the most valuable of indigenous scrubs. The settlement of questions affecting local nomenclature will be expedited if those interested will kindly forward to the Government Botanist specimens of the various scrubs with details as to local names.]

Memorandum upon Protective Inoculation against Anthrax.

(Cumberland Disease, Splenic Fever, Charbon *Fr.*, Milzbrand, *Ger.*)

DR. FRANK TIDSWELL.

By direction of the Chief Medical Officer of the Government, this memorandum has been prepared in response to the request of the Hon. the Secretary for Mines and Agriculture for a general report "On the Question of Inoculation for Anthrax."

The disease which has to be considered was one of the first in which the casual agent was proved to be microbial, and it has been the subject of more numerous, varied, and elaborate investigations than any other ailment of like nature. To give a full account only of the experimental observations bearing on the point to which my task is limited would involve a communication of considerable, and indeed undesirable, length. I have been obliged, therefore, to select from the great mass of evidence only such as appeared adequate to sufficiently illustrate the various points raised, and to touch but lightly on several very important matters deserving of fuller consideration.

In contrast to the abundance of experimental evidence there is a singular dearth of valid records concerning the employment of inoculation as a practical measure for the protection of sheep and cattle. Such as I have been able to collect from available papers and reports have been presented in their proper place.

Natural and Acquired Immunity against Anthrax.

As regards their behaviour towards anthrax, animals may be liable to its attack, when they are said to be naturally susceptible, or not so liable, when they are said to be naturally immune. These predilections generally characterise whole species; thus sheep, cattle, deer, pigs, goats, horses, and mankind are naturally susceptible; whilst rats, cats, birds, amphibians, and fishes are naturally immune. But in a few instances the disease distinguishes between varieties of a single species, *e.g.*, whilst most breeds of sheep are susceptible to anthrax, Algerian sheep are immune.

In the ordinary course of their existence, the natural tendency is closely adhered to, and animals become, or do not become, affected with anthrax accordingly as they are naturally susceptible or naturally immune. But it has been found that the natural attitude may be

profoundly modified, or even reversed, by either fortuitous or artificial means. Thus, whilst anthrax has never been known to occur as a natural event amongst mice, guinea pigs, and rabbits, these are, of all animals, the most susceptible to inoculation. The naturally-immune Algerian sheep can be infected by giving very large doses; white rats, if inoculated when fatigued or under the influence of chloroform narcosis; fowls, if their body temperature be reduced by standing them in cold water; and frogs, if their body temperature be raised by keeping them in water heated to 35 degrees centigrade.

In all these instances there is a change from immunity to susceptibility; but the converse process is equally possible. Susceptible animals which have survived an attack of anthrax remain for some time afterwards immune against further attacks. Rabbits, which generally succumb to inoculated anthrax, may be preserved by inoculating other bacteria (*M. erysipelatis*, B. of Friedlander, *B. pyocyaneus*), either at the same or within a short time after the anthrax (Emmerich, Most, Sholl, and Isuboi).

Hence it will be seen that the natural barriers may be broken down, and, owing to exceptional circumstances, natural susceptibility and immunity may give place to immunity and susceptibility respectively. Such changes of condition are referred to as "acquired"—acquired immunity and acquired susceptibility as the case may be—in contradistinction to the natural immunity and natural susceptibility previously mentioned.

The Conditions under which Immunity is secured by Inoculation.

The possibility of obtaining protection against anthrax by inoculation has its origin in these transpositions. The object of the process is to confer an acquired immunity against this disease on susceptible animals, such as sheep and cattle. Its feasibility is based on a fact already mentioned, viz., that one attack of anthrax protects the survivors against further attacks. (Toussaint, Pasteur); in the words of Pasteur's celebrated dictum—"*Le charbon ne recidive pas.*" To fulfil the required conditions the animals must be subjected to an attack of anthrax, mild enough to permit of recovery, severe enough to render them immune.

It is scarcely necessary to state, but important to bear in mind, that anthrax is caused by a microbe—the bacillus of anthrax—and that the disease never occurs save after infection with this microbe. The rationale and value of protective measures depends on certain biological characters—habits, so to speak—of the bacillus, and upon certain means at our disposal by which these habits may be modified. In particular we are concerned with the ways in which the infective power or "virulence" can be controlled and adapted to the purpose to be served by protective inoculation.

The bacilli in their ordinary condition, as derived from a previous case, are not in general suited to this purpose. Animals have been exposed to natural infection from mild cases, inoculated with bacilli in

numbers supposedly too small to cause death, and, instead of being inoculated, have been fed on material containing the bacilli. Sometimes the resulting attack was mild, usually it was severe, often it was fatal, and always it was beyond control. Once inoculated, the bacilli did as they pleased, and their great virulence rendered the chance of a successful issue very precarious. Such methods were too risky to have any practical value.

Consequently, various procedures have been devised whereby the bacilli could be reduced to a more manageable degree of virulence—trained, as it were—to produce only a mild attack. This reduction of virulence, or "attenuation," as it is called, has been accomplished in a variety of ways, all of which have the common basis of subjecting the bacilli to influences which impede their full development, the deficiency being exhibited, *inter alia*, by lessened virulence. The only one of them that needs consideration in this place is the effect of heat, which is made use of in Pasteur's method of vaccination.

The attenuating influence of heat depends upon the fact that anthrax bacilli develop normally only within certain limits of temperature. They flourish best at the temperature of the animal body (37 to 39 degrees C.), become progressively less and less vigorous as this temperature is departed from, and their growth ceases altogether when the temperature is raised to 45° C., or reduced to 12° C. In Pasteur's method the bacilli are artificially cultivated in an oven heated to 42°—43° C. They continue to grow at this temperature; but their virulence becomes gradually reduced, according to the length of time they are kept in the oven.

At first they are virulent for all susceptible animals; but day by day they become more and more attenuated, and cease to affect such animals species by species in the inverse order of their susceptibility. For each species of animal there is a stage at which the bacilli, whilst producing a mild illness, do not cause death. Bacilli whose virulence is so reduced are taken as a suitable "vaccine" for the species of animal concerned.

After inoculation with this vaccine the animals go through an attack of anthrax, and thereafter are found to be immune, not only to vaccine of the same, but of higher virulence. It may be that one vaccination will protect against the fully virulent bacilli; but this depends on the strength of vaccine that can be used, for it is necessary, in the first place, to inoculate a vaccine that will not kill the animal operated upon.

In the practical application of the method for the protection of sheep, Pasteur and his collaborators found that these animals could not at first withstand a vaccine strong enough to protect against bacilli of ordinary virulence. They, therefore, devised a method of two vaccines—the first weak, but protecting against the second, which was stronger, and, in turn, protected against fully virulent bacilli. The ultimate effect was that, by means of these two vaccines, the sheep were rendered immune against any bacilli they were likely to meet with in nature. Since its first establishment the method has been modified in one or other technical detail; but essentially it has remained the same till the present day.

Chauveau has also elaborated a method of attenuation by heat, applied in a way slightly different from that of Pasteur, but this method also requires the use of two vaccines.

Recently Messrs. McGarvie Smith and Gunn, of Sydney and Narrandera, in this Colony, have stated that they have discovered a method of conferring protection by one vaccination. No details of their method are available; the process is a business secret. Immunity has been obtained by one inoculation in laboratory animals, and it may very well be that these gentlemen have succeeded in working out a method applicable to the sheep in the field, but so far as I am aware there is no published account of their method having been subjected to rigid scientific tests such as Pasteur's has successfully undergone.

Apart from this particular instance no one appears to have discovered anything better than Pasteur's method, which has held for eighteen years, and still holds, the field in Europe against all rivals. Even in the laboratory it has remained the most usual method of obtaining immunity against anthrax for experimental purposes.

The Reason and Significance of Mortality attendant on Inoculation.

As already stated, inoculation aims at giving animals an attack of anthrax, but by the use of specially modified bacilli it is attempted to insure that the attack is non-fatal. The latter condition cannot always be fulfilled; it is impossible to regulate absolutely the incessant changes that symbolise life.

The bacilli in the vaccines are alive. As their virulence may undergo attenuation, so also it may be exalted again, and the existence within the body of a susceptible animal is a condition the most favourable to its recovery. If Pasteur's first vaccine be injected into a guinea pig, the animal will die; the bacilli obtainable from its blood have so far recovered their virulence as to be able to kill sheep. It is possible that in some instances a similar exhaltation of virulence occurs when the vaccine is inoculated into the susceptible sheep. But the sheep is also alive, and on its side there is variability as to the amount of resistance opposed to the bacilli. Some sheep appear to be so susceptible as to be unable to resist even the attenuated bacilli of the vaccines.

Owing to the operation of one or other, or of both, the factors just mentioned, a certain number of sheep die as the direct result of the operation. This is indicated by a pithy expression in Pasteur's original communication, "*les inoculations qui ne tuent pas sont preventives.*" Indeed, this immediate mortality is so constant that it may be considered a test of the efficiency of the vaccination, and if confined within certain limits, it is to be regarded with satisfaction. As an indication of what may be taken as the right and proper thing in this respect, the following figures are quoted from a report by Chamberland on the results of the application of Pasteur's method in France during the twelve years, 1882 to 1893 inclusive. For comparison with them I have added figures from the reports of the Chief Inspector of Stock

for 1894-97, and contained in the returns voluntarily furnished to him concerning vaccinations performed in this Colony.

Place.	No. of Sheep Vaccinated.	Mortality after Vaccination. After 1 Vaccination.		After 2 Vaccinations.		Total.	
France	3,296,815	5,668	·32%	4,406	·24%	10,074	·3%
New South Wales ...	2,432,016	2,043	·08%	12,222	·5%	14,265	·58%
	(a) 1,476,982	1,396	·09%	10,017	·6%	11,413	·77%
	(b) 955,034	647	·06%	2,205	·23%	2,852	·28%

In this Colony vaccination is carried on as a matter of private business by either (a) the representatives of the Pasteur Institute, or (b) Messrs. McGarvie Smith and Gunn. The respective results have been separately stated in a subdivision of the above table, as far as they are shown by the returns.

By comparing the figures for France and New South Wales there will be seen a striking inversion of the proportionate mortality after the two vaccinations. In France the mortality was higher after the first vaccination; in this Colony it has been higher after the second. The inversion is preserved in the returns of both firms operating in this Colony. The significance is not clear, but probably the first vaccine used in this Colony is milder than that used in France.

In the practice of the representatives of the Pasteur Institute the total mortality has been much higher than in France; in that of Messrs. McGarvie Smith and Gunn it has been slightly less. In so far then the latter have had the better success.

The basis upon which the efficacy of inoculation must be estimated.

It follows from what was said in a previous section of this memorandum, that immunity towards anthrax may be either natural or acquired. Superficially there is no recognisable difference between the two; both are known by the same thing, viz.:—resistance to infection. But essentially they are unlike in many respects, and amongst others in this, that whereas natural immunity is a quality deeply inherent in an animal's constitution, permanent, or at all events strongly opposed to alteration; acquired immunity is an artificial character, transient, and apt to be lost. Consequently in dealing with immunity it is very necessary to know whether it is natural or acquired. If natural one may expect it to remain unchanged, if acquired one must be prepared for its disappearance. So also in the case of susceptibility; natural susceptibility tends to persist, acquired susceptibility to fade. Briefly, in the case of both immunity and susceptibility the tendency is to remain in, or revert to, the natural condition.

Immunity to Anthrax conferred on sheep and cattle by vaccination being of the acquired variety, it is not surprising to find that its duration is limited. A German commission, appointed to inquire into

this aspect, reported that some animals became infected four months after vaccination.

Professor Kleih, in a report to the Local Government Board, England, stated that animals remained immune to inoculation with virulent cultures for nine months after vaccination.

French authorities consider that the immunity will last for a year at least. The probability is that the duration differs in different animals; in some the immunity is long retained, in others it passes away more or less rapidly. Experience seems to show that the French predication may be relied upon for practical purposes, and that their rule of repeating the vaccination annually is a safe one to follow.

In view of the importance of the time limit, it is customary to estimate the value of vaccination on the basis of the number of deaths from anthrax occurring amongst vaccinated animals during the twelve months next succeeding the date of the operation. The assessment of the mortality includes the deaths resulting from vaccination, and these taking place later but within the specified period. On these principles Chamberland has estimated that in France the total percentage of losses of sheep from anthrax has been reduced by vaccination from 10 per cent. to ·94 per cent. Other European observers report in favour of the method, thus Wysokowicz (Russia) states that the mortality amongst vaccinated sheep was ·87 per cent. as compared with 8·3 per cent. amongst the unvaccinated, and Hutyra states that the mortality of vaccinated sheep was 2·18 per cent., as compared with 10 per cent. amongst the unvaccinated sheep.

Unfortunately, data are not available for a similar estimate of the value of vaccination in this Colony. Neither the present nor the previous mortality from anthrax is known. Nevertheless, the belief is very general that vaccination has reduced the losses of sheep from anthrax. However correct this may be, it lacks the support of statistical evidence, and so it remains opinion, and is not entitled to the importance of fact. We are not, indeed, in a position to offer a satisfactory answer to the great argument against the value of vaccination, for we cannot show that the reduction of losses was actually due to this measure. Only a small proportion of our sheep are vaccinated, not more, it would seem, than two or three millions of the fifty millions annually present in the Colony. According to the reports of the Chief Inspector of Stock (1894–1897) there have been no serious losses of sheep from anthrax anywhere in the Colony, *i.e.*, neither in the vaccinated or unvaccinated, during the years since vaccination has been practiced. There is thus no evidence that vaccinated sheep have been exposed to risk. In so far this militates against accurate judgment, for in order to establish the efficacy of vaccination it must be shown that the vaccinated sheep survived an exposure to infection which proved fatal to unvaccinated sheep.

This line of criticism was applied to the French statistics by Cope, who, in a report to the Board of Agriculture, England, 1894, asserted that the official returns showed that only some of the vaccinated flocks were afterwards exposed to infection; and that where such exposure occurred, the mortality was as high amongst the vaccinated as amongst

the unvaccinated sheep. Some other authorities stand beside Cope in denying the value of vaccination, and many express very cautious opinions on the subject; but, on the other hand, many experts declare for it, and popular opinion seems entirely in its favour. In this Colony we appear only to have popular opinion to guide us, and this, though good as far as it goes, is insufficient as regards final decision.

Certain disadvantages of inoculation and the possibility of securing immunity by other means.

German authorities (Koch, Gaffky, Loeffler) have raised objections to inoculation methods on the grounds that they introduce living bacilli which may escape and become a source of infection for other animals, or may infect the soil, in which the bacilli continue to live and make the locality an endemic centre for anthrax. This objection is based on the assertion that the attenuated bacilli of the vaccines may recover their virulence in the body of the sheep, and, being eliminated therefrom, they may become a source of danger to unvaccinated sheep. This does not seem to merit much importance in practice provided all the sheep of a flock are vaccinated, for then all of them are protected. But it suggests danger when only part of the flock is treated, for then the disease may spread to the unprotected part. It should also induce caution in introducing vaccination into clean country.

In order to avoid the possibility of disseminating infection by vaccines, attempts have been made to produce immunity without the use of living bacilli. The means to this end are suggested by the results of observations on the nature of virulence. Researches have shown that the bacilli produce a poison, or, as it is technically called, a "toxine." This toxine is to be obtained from artificial cultures of the bacilli, and also from the bodies of animals dead of anthrax. When injected into animals, the toxine produces effects similar to those which follow the inoculation of living bacilli. The methods of attenuation previously referred to act by reducing the power of toxine production, and if pushed to extremes may end by entirely depriving the bacilli of this special property. The bacilli continue to grow, and are the same in general appearance and behaviour, save that they no longer produce disease when inoculated into animals. Short of entire deprivation, the ability to produce toxine corresponds with the degree of attenuation. The outcome of the researches is to the effect that the toxine is the real cause of the symptoms of anthrax, and that the bacilli are only virulent when, and according to the degree in which, they produce it.

Hence, immunity to anthrax indicates a state of toleration of the toxine. In proof of this, it has been shown that by treatment with toxine alone animals can be immunised not only against further doses of texine, but also against living bacilli of full virulence. This immunity has been obtained by using the crude toxine, as separated from cultures (Chamberland and Roux, Petermann), and also by more purified products obtained from the crude toxine (Arloing, Hankin,

Wesbrook, Sydney Martin, Marmier). In one case it was found that the immunity endured for several months (Chamberland and Roux).

All these successes have hitherto been confined to laboratory experiments, but they are importantly suggestive of economic possibilities, for the superiority of toxine over vaccination is very great. By vaccination living bacilli are introduced; these may become a source of infection for other animals or the surroundings; within the body of the vaccinated animal they multiply and produce different effects in different animals; it is impossible to regulate the dose, and so the effects cannot be controlled. By treatment with toxine no living bacilli are introduced; there is no possibility of spreading infection; the toxine does not multiply in the body; the dose can be exactly measured and guaranteed to produce just so much effect and no more. But as already stated, there is no record of any field trials of toxine methods. It remains for the future to decide whether or not we shall be able to avail ourselves of their advantages.

As an off-shoot of the toxine methods, it has been found possible to prepare an antitoxic serum similar to diptheria "antitoxin," which will both prevent and cure anthrax (Marcheux, Sclava, Soberheim). This subject has been little developed, and the serums so far obtained have not possessed much antitoxic virtue.

The foregoing sections contain an outline of the more important questions that need to be considered by those who seek the aid of protective inoculation against anthrax. I have endeavoured to emphasise the fact that inoculation involves interference with the natural relationship of animals towards this disease. For this reason alone some restrictions on its value might have been anticipated, and, as we have seen, the acquired immunity is limited in both degree and duration.

It is regretable that information on these two points is not sufficiently explicit to finally settle the main question of the value of vaccination. An appeal to European authorities has revealed a conflict of opinion, and we do not seem ourselves to possess the date necessary for a convincing expression of our belief in its efficacy as a practical measure.

It is still less possible to form a valid judgment as to the respective merits and demerits of any particular method of vaccination. Direct experiment would not be likely to lead to a satisfactory verdict on this question, for although there is nothing clearer than the experimental efficacy of Pasteur's method, its value in field work is still a matter of controversy. Whether or not it is desirable that the vaccination should be entirely in the hands of private individuals I do not pretend to decide; but this much is certain, that its being so is not a matter of necessity.

Revision of the present methods of vaccination might result in improvement, especially in the direction of the substitution of toxine for living bacilli; but as investigation on this head would have to be carried into unknown regions, it is impossible to predict what, if any, advances would be made.

My inquiry suggests the recommendation that steps should be taken to secure more accurate returns concerning vaccination for anthrax in this Colony. They would yield information not only of local importance, but also of international interest. In order to be serviceable, that must be exacted by legal compulsion with a penalty for neglect. For this purpose new legislation would probably be required, since existing statutes do not appear to cover such a demand.

I venture to exceed the limits of my brief, in so far as to call attention to the necessity of not neglecting measures against anthrax other than vaccination.

In the novelty of the new method the well-tried virtues of the old familiar ones must not be forgotten. To my mind such measures as isolation of infected stock, and the destruction of infected carcases and pastures are more important than vaccination such as is now possible. The latter may safeguard the interests of individual owners; the former make for the benefit of all. Consequently I am of opinion that any new legislation on the subject might advantageously include provision for the immediate notification of the occurrence of anthrax in sheep or cattle with power to take measures to prevent its extension.

THE PRICKLY PEAR PEST.

Mr. J. L. THOMPSON, Travelling Instructor in Agriculture, has received from a Queensland correspondent the following communication in regard to a specific for the destruction of prickly pear:—"During a residence of twenty-five years in Queensland I have noticed the ravages and spread of the prickly pear on some of the finest lands in the Colony; and though many attempts have been made to stay its spread, like the ticks, it has continued a great pest. By an accident some patent stuff that was being used for the dressing of some ticky cattle (called 'hide or skin poison') was thrown down on to some prickly pear, and in the course of a few days it had completely killed it, and on examination of the place afterwards it was seen that the pear had gradually died away to its very roots. The result was so good that it was tried on a large patch with equally good results. I have noticed in the *Queenslander* and other papers that it has been tried with similar effect at several places. The stuff was supplied by the Stock Department of Queensland for tick dressing, and is put up in 4-gallon tins. In using, the preparation is mixed with cold water to the strength of 1 to 30. From my own knowledge I can strongly say it is the most effective spray that I have ever seen used for the prickly pear, and I think the recipe should be made known to all who suffer from the pest." It may be added that the Queensland Department of Agriculture have been asked for full particulars of this preparation.

Dairy Bacteriology.

(Continued from p. 822.)

M. A. O'CALLAGHAN.

Pasteurisation and Sterilisation.

In the last issue I gave what I hope my readers will consider a full explanation of what was meant by the term "Pasteurisation," and I will now deal with the other word which is so often confounded with it, viz., "Sterilisation." Now, while the word "Pasteurisation" cannot be found in English dictionaries, the word "Sterile," from which "Sterilisation" is formed, is a very common one. Its meaning in modern dictionaries is given as "barren, unfruitful," *i.e.*, "unproductive or without life," and whereas "Pasteurisation" does not convey the idea that all micro-organisms have been absolutely and completely destroyed, the word "Sterilisation" means that all life has been destroyed, and hence that no further crop (if I may use the term) can grow—thus the liquid, which in this case would be milk, is barren or unproductive so far as bacterial life is concerned; and as long as it is kept sealed so as to prevent contamination from the atmosphere, so long will it continue to remain sterile. Now it may appear to be a very simple thing to sterilise milk, but in practice it is found extremely difficult to do so unless the milk is derived from a very pure source and kept in the condition which will check bacterial growth until such time as the milk is delivered at the factory or laboratory where the sterilising process is to begin.

The condensing of milk is closely related to the sterilisation of milk, because, properly speaking, a condensed milk ought to be sterile, and rendered so without the use of chemical agents or preservatives other than sugar. The reason that it is so difficult to sterilise milk is that, as before stated, it is a suitable medium for the growth of almost all varieties of micro-organisms, and some of these varieties are so tenacious of life that should they get access to the milk the process of killing them is rather a long one; in fact, there are some varieties of bacteria which, once they have got fairly under weigh in milk, it will be absolutely impossible to render that milk sterile without the use of chemical agents or bacterial poisons—meaning substances that will poison or stop the growth of bacteria. Fortunately these organisms are not frequently found in milk, especially if the utmost cleanliness is observed in dealing with same from the moment it is drawn from the cow until it reaches the factory. Commonest of these highly resistant organisms are those which cause butyric fermentation, which fermentation or decomposition is accountable for a great deal of the rancidity and cheesy flavours which butter assumes after it has been held for some time. To check these fermentations, as well as others, the

butter is placed in cold stores at a temperature so low that though it does not destroy these micro-organisms it materially checks their growth, and hence the butter does not decay, save very little. However, immediately the temperature of this butter rises, butyric fermentation begins, and thus it is that many of our butters decompose so rapidly after they have been taken out of the cold store, and this was (and is still) the chief complaint which the English grocer had to find against Australian butter.

Now, my readers will understand that although through sterilisation, if the process had been begun in time, before bacteria of these highly-resistant types have propagated to any extent, the milk could be by the application of heat rendered free from bacterial life, the pasteurising of such milk would not be sufficient to destroy these micro-organisms. If, however, a milk or cream be pasteurised properly before fermentation of this kind has had time to get well under weigh, the organisms that so readily produce these injurious fermentations would be so few and these few would be so weakened by the process of pasteurising that their power of reproduction or future propagation would be so diminished that they would be practically unable to carry out their undesired functions in an article like butter, and hence it would preserve its flavour for a considerable length of time. Thus it is that the butter from pasteurised cream should keep longer than butter from unpasteurised cream; just the same as meat that has been boiled or even partially cooked will keep much longer than raw meat. As far as meat is concerned, partially cooking is similar to pasteurising, and thorough cooking, or boiling for a considerable length of time, to sterilising. To explain still further, the reason that pasteurisation will not destroy all bacterial life is that some of the micro-organisms have the power of producing spores or seeds, and these spores are able to withstand a heat which would readily destroy the growing plant, just the same as the seeds of our common plants will not be readily destroyed by frost, whereas the growing plant withers up and decays. In the process of sterilising, therefore, we have to allow some time to intervene, so that these seeds or spores may again germinate into plants; and then, by applying heat when they are at this stage of their growth, they readily succumb. Heat has usually to be applied a third time, as some of the spores may have remained behind, and may not have germinated into plants at the date of the second application of heat, and another period is allowed to elapse, so that these may be treated while in a growing stage, and thus all life destroyed. This is what is called "Intermittent Sterilisation," which practically means pasteurisation applied three times at different intervals. The other process of sterilisation, known as "Direct Sterilisation," requires the application of very high temperatures continued under pressure for a considerable length of time—a system which is not practised in all laboratories or factories that go in for the sterilisation of substances such as milk. From this it can be gathered by the farmer, as well as by the factory manager, that if the process of pasteurisation is to do the most good the milk or cream must be treated before fermentation has been allowed to develop

much, as if fermentation is allowed to develop considerably it would require almost a lengthened process of sterilisation to render the milk as free from injurious bacteria as pasteurisation would have done at an early date. Hence it is that the pasteurisation of sour or slightly sour cream will not be found satisfactory or so productive of good as the pasteurising of the milk or cream when either is quite sweet, *i.e.*, free from any marked fermentation. For this reason also the pasteurisation of milk will probably be found in this warm country to be more efficacious and more conducive to the manufacture of high-class butter than will the pasteurisation of the cream, unless the cream be pasteurised at the separating stations immediately it leaves the separator. If the cream has to be carted any distance in this warm climate, fermentation will have set in before it reaches the central factory, and, if any of these highly-resistant and injurious micro-organisms have obtained access to the cream, its proper pasteurisation will be rendered almost impossible. Sometimes it will be found that when sour cream is pasteurised considerable good will result; and sometimes, again, it will also be found that the pasteurising of sour cream only means a more inferior butter than if the cream had not been treated at all. It is thus seen that partial success or entire failure may be the outcome of pasteurising old cream, and the issue will entirely depend upon the varieties and number of micro-organisms present in such cream. If none of these very highly-resistant types of bacteria are present, the pasteurising of sour cream will rid the product of the other forms of bacteria, and these very undesirable fermentations be further prevented. But should very injurious micro-organisms be present in the milk they will have considerably multiplied by the time the cream is a couple of days old, and then well pasteurising will destroy or materially check other forms of growth and consequent fermentation, such as lactic acid producing organisms, leaving the field clear for the work of the tenacious and injurious forms, and thus they will be able to carry on their mischief at a greater rate and with more effect in the pasteurised product than if the cream had never been treated and all the other forms of bacterial life were allowed to continue and fight these very injurious ones for supremacy. The development of lactic acid seriously checks the growth of many varieties of bacteria, and hence if this fermentation gets well under weigh the butter-maker has a great chance of getting a cream that will produce for him, if it be not allowed to get over-ripe, a first-class article. Thus the addition of lactic ferment to freshly-separated cream, even though the cream has not been pasteurised, is often a very material help in checking undesirable fermentations and in leading to the production of a good butter, and hence it is that when pasteurisation is adopted to milk or sweet cream, though the process does not render the milk or cream absolutely free from bacterial life or sterile, the addition of lactic acid producing organisms in the shape of lactic ferment in large numbers, ensures a perfect fermentation for the butter-maker, and guarantees a well-flavoured butter that should, with proper manufacture, keep a considerable length of time.

I have repeatedly made bacteriological examinations of the milk before pasteurising, and the cream after pasteurising, and of the butter made from the pasteurised cream; and though the original milk contained many varieties of organisms (some injurious and some non-injurious to the butter-maker) the pasteurised cream before the addition of lactic ferment contained no organisms possessed of life, or else had insufficient life left to make any growth for several days, and on examination of the butter made from such cream, almost no other form of bacterial life was found to be present save that of the lactic acid species which was added to the cream for producing lactic fermentation, thus clearly proving that the *weeds* were killed; the ground was planted with only pure seed, and the resulting crop was practically free from any foreign plants. This has been for years the aim of the brewer, and this should be also the aim of the modern butter-maker, especially those who manufacture in Australia and have to make an article that will retain its good qualities until it is consumed by our friends 13,000 miles away, viz., in England.

From what I have stated, therefore, it is seen that the presence of a pasteuriser and a capable operator in a factory does not necessarily mean good butter. The farmer must also do his part, and supply his milk to the factory in a cleanly condition for pasteurising after the best manner, and he must not go away with the idea that now because the factory has a pasteurising plant he need not bother his head any further about extra cleanliness. The pasteuriser will enable the factory to make a better butter, and hence enable the farmer to get a higher price for his product, but it can only be done by the farmer adapting himself to the requirements of butter-making on the highest scale. He must not send milk which has been allowed to stand all night in *unclean vessels,* and which is tainted when it reaches the factory; he cannot prevent at all times some injurious micro-organisms getting into his milk, but what he can do is to deliver the milk at a stage and in a condition which will enable the pasteurising plant and the manager to destroy these micro-organisms, and thus prevent the mischief which they would work in the butter at an after-date if the pasteuriser was not present.

(To be continued.)

Special Rail Rates for Commercial Fertilisers.

It will be remembered that some time ago, at the instance of the Department of Agriculture, the Railway Commissioners arranged a special schedule of reduced rates for the carriage of small lots of fertilisers. Judging by reports that from time to time reach the Department, the concession has proved a great boon to agriculturists, who have thereby been encouraged to try the effects of applications of the many excellent manures now on the market.

In accordance with a request made through the Department by the local agents, Messrs. Hawken and Vance, the Railway Commissioners have agreed to place jadoo fibre and liquid in the schedule of artificial manures.

Notes on some Wheats in General Cultivation in New South Wales.

(Continued from page 415.)

W. FARRER.

White Tuscan.—As I have already said, two different wheats have been going under this name, one in South Australia and the other in this Colony. It is for the latter that it has been decided to retain the name of White Tuscan. The New South Wales White Tuscan has always enjoyed a good name, especially for excellence in the mill; but for all that it is not largely grown, and its cultivation seems to be on the decrease. The reason of this probably is that although it is a good all-round kind, it possesses no single excellence which causes it to be specially good as a grain-producing variety. Its grain certainly yields a large percentage of flour, but it is of low strength, although of excellent colour. White Tuscan is a rather late midseason variety, and is decidedly later than Purple Straw, to which variety it has had to give way on that account. As Purple Straw is, in fact, a little its superior in several respects—in earliness of ripening, in the stoutness of its straw, as well as in the appearance of its ears and in suitability for our interior, and inferior to it in none as a grain-producer, it can scarcely be wondered that it has taken the place of White Tuscan, and that it has done so gradually. It may be that White Tuscan is the better variety for some localities; but of this I have no evidence; and any standing it still holds as grain-producer comes from the tradition of the good name it enjoyed before Purple Straw came to us. There is one purpose, however, for which White Tuscan is decidedly superior to Purple Straw: there are, in fact, few varieties which surpass it as a hay-wheat, and on that account it will probably continue with us as long as wheat is grown for hay, or until we get another variety which is equally good for hay and superior to it in other respects. Frampton is a variety which resembles White Tuscan in many respects and notably in its suitability for a hay-wheat, for which purpose, I understand, it is much valued in the southern colonies. In its season it is much the same as White Tuscan; but it is, if I recollect it right, somewhat more leafy, and, probably in consequence, more rust-liable. If it behaves in the mill as well as White Tuscan, it is likely to be worthy of attention for growing for hay in our interior, as it appears to have in it some of the blood of Purple Straw: the dark-green colour of its foliage ought to cause the hay made from it to be of specially good colour. It is possible I may have more to say about Frampton after next harvest.

Golden Drop.—This is a variety we now hear very little about. Its fault of liability to rust is so great as to have practically driven it out of cultivation; but its good qualities are so numerous and so conspicuous as to make it doubtful whether it is not being neglected too much—at any rate, in the drier parts of the Colony. Golden Drop is one of the varieties which used to be grown largely in South Australia, and helped, I believe, at least as much as any other variety, to win for the wheats of that Colony their high position in the London market; but several years ago, a rusty season so completely destroyed the crops of it that the farmers of that Colony have not dared to grow it since. In our dry interior, this variety is probably worthy of attention, and certainly would be if it were a little earlier. I have not grown Golden Drop at Lambrigg for several years; but this year it has been planted with the object of making it the parent of a cross-bred variety which shall be early enough to be rust-escaping and shall inherit the good qualities of its parent in the mill. Golden Drop is a mid-season ripener; its straw is stiff and stout, of about average height, and of excellent quality, and its habit of growth is level-headed and excellent. The light-green colour of its foliage is one of its most prominent characteristics, and the absence of a glaucous tint from it is, I believe, one of the principal causes of the excessive liability of this variety to rust. Golden Drop stools well (this I do not regard as a valuable quality for our interior), and is very productive of grain which is of good size, mellow in appearance, and attractive, and is, as I have already said, as regards the colour and texture of the flour it yields, of the very first quality; but its flour, like that of the great majority of soft wheats, is of low strength, in which quality it differs little, if at all, from Purple Straw.

Farmers' Friend.—This variety has probably originated from Golden Drop, and on that account I am taking it here. From its appearance in the field when it is ripening, I have formed the opinion that it has come from a cross between Golden Drop and Purple Straw; and were it not that it has inherited so much of the liability to rust of Golden Drop its other good qualities would make it to be about the very best of the Purple Straw family of wheats. It is remarkable that this variety should not have entered more into general cultivation than it has done in our interior; for it appears to have all the good qualities of Golden Drop, and is appreciably earlier than that variety, and on that account is less liable to be injured by rust. Farmers' Friend is apparently as productive as Golden Drop, and its grain is of the same high quality. In the character of its straw and in its habit of growth it also closely resembles that variety. It ripens with Purple Straw, and is inferior to that variety in no respect except in liability to rust; in productiveness it is probably, on the whole, its superior. In milling quality Golden Drop and Farmers' Friend are apparently to all intents and purposes identical. Farmers' Friend is a free-stooler, and on that account ought to be sown pretty thickly—not less than 50 lb. to the acre with the drill, or from 80 to 90 lb. broadcast, for if the seeding be too thin, the plants, from continuing to stool as long as possible, ripen later, and are therefore more liable to be injured by

rust; they also form too many heads then for a single set of roots to do justice to and fill with plump grain, if the soil is at all dry when the grain is being formed.

Rattling Jack.—This is another member of the Purple Straw family of wheats. Its close-set, full-tipped heads make it to be one of the most productive looking, and its short and stout straw and level-headed habit of growth one of the most desirable looking and attractive members of the family to which it belongs. Its external characteristics, indeed, mark it for the Square-head of Australia. However, it has not yet taken the position in our wheatfields that Square-head has at Home; nor do I think it is likely ever to do so; for in almost all its qualities, except in those which specially appeal to the eye, Rattling Jack is, apparently, somewhat inferior to most of the other Purple Straw varieties. Its stout straw and sturdy habit of growth are spoiled by too ample foliage and broad leaves, which mark it for an easy prey to the rust parasite, the attacks of which, in fact, it seldom escapes. An important quality, in which Rattling Jack is decidedly inferior to most of the other members of the family, is the amount of resistance it offers to drought; for the sample of grain it produces in a dry season is usually poorer than that of most of the other Purple Straws. In its time of ripening it is apparently a day or two later than Purple Straw. The shortness and stoutness, or rather coarseness, of its straw make Rattling Jack to be inferior for a hay-wheat. In the mill, however, it holds its own with most of the other members of its family and produces flour of the same soft texture and creamy colour. Its stout straw and sturdy growth have led me to make use of Rattling Jack as a mother in cross-breeding; but it appears to possess far less ability to transmit its good than its bad qualities. On the whole, I regard Rattling Jack with less favour than most of the other Purple Straws, and, in this district at any rate, would always give the common Purple Straw the preference. The variety known as Grosse's Prolific appears to be in every respect identical with Rattling Jack.

Red Straw.—This variety ought, perhaps, to have been taken the first of the Purple Straw family, of which it is the parent, instead of the last. However, it has been almost entirely supplanted by its progeny, and in South Australia, where it was once grown very largely (in this Colony, I believe, it was never much grown), the tradition of the great name it once had, as is the case with White Tuscan in this Colony, causes it to retain a certain standing in some districts. At Lambrigg Red Straw is little, if on the whole at all, inferior to Purple Straw. In its habit of growth the latter is certainly the more attractive, for its ears are finer-looking and give an impression of superior productiveness; and its straw is stiffer and somewhat stouter; it also carries its heads at a more even height from the ground—is more level-headed. I doubt, however, if in reality there is any material difference between the productiveness of these two varieties, or that either is materially the better in any respect, unless it be that Purple Straw is rather the better for the stripper, and that the less coarse straw of Red Straw makes it to be the better hay-wheat. Some

years ago I noticed, in one of my drills of Red Straw, a plant which showed many of the characteristics of Rattling Jack. This plant I harvested by itself, and find that its progeny retain the peculiarities of their parent plant. Whether this plant was a sport from Red Straw, or a natural cross-bred between it and Rattling Jack, I cannot tell for certain, but I incline to the opinion that it was a sport, and that Red Straw has inherent in it a tendency to produce sports of the type of the English Square-head; and that Rattling Jack probably originated as a sport from Red Straw. In the mill, as might be expected, Red Straw behaves much like the other other members of the Purple Straw family—that is to say, it produces flour of rather low strength, but of a beautifully creamy colour and of good texture. It is about as rust-liable as the other members of the family, and in this respect is superior to none of them, unless it be Rattling Jack, and, of course, Farmers' Friend, for Golden Drop itself can hardly be considered to belong to the Purple Straw family.

(*To be continued.*)

Cold Storage of Eggs.

For the information of farmers and others desirous of placing eggs in cool storage during the spring and summer months, the following Directions and Regulations are published by the Board for Exports:—

Directions.

In order that eggs may be kept fresh and good for from four to six months, it is necessary to see that only new-laid ones be selected; where possible, also, it is advisable to have them infertile, as, when fertile eggs get exposed to a temperature of 98 to 100 degrees for even a short time, the germ will start into life, and no subsequent treatment will then avail to give them the quality of freshness. Eggs for storage should be gathered every morning, before the sun has gained strength, and placed at once in the storage boxes in a cool place. To attain the highest success, they should be graded as to colour and size, the boxes being marked accordingly. Care should also be taken to have them clean and free from unsightly stains. The boxes used should be of the usual trade size, holding 36 dozen, and packers should see that they are made of odorless timber, as eggs are peculiarly liable to absorb flavours from their surroundings. Another important point is to see that the boxes and fillers are thoroughly dry before using; otherwise mustiness is almost sure to ensue. Beyond the fillers of tasteless cardboard, no packing of any kind should be used, as the natural moisture exuding from the eggs should be allowed to escape, otherwise a musty flavour is likely to be perceivable when the cases are opened. Eggs for storage should be forwarded as soon as packed, by quick train or steamer, and handled on the way with the greatest care.

Regulations.

1. All eggs forwarded for cool storage must be sent, carriage and cartage prepaid, to the Government Export Depôt, Darling Harbour, and a letter or post card advising despatch posted to the Secretary's office at same time.
2. The cases will be received and stored on the owner's account and at his sole risk, and the Government will not be responsible for any loss or damage said to have occurred while the eggs are in store, from whatever cause arising.
3. Store receipts will be issued to the owner, or his agent, when the cases are deposited, and delivery will only be made on production of such store receipts and payments of all charges for handling and storing, as per schedule herein.
4. Cases must be of the kind known as "patent packers," each holding 36 dozen properly packed in cardboard fillers, as supplied with the cases.

When the eggs have to come long distances, owners would do well to arrange for having them examined before being put into store, and all cracked ones removed, as no responsibility is taken for breakage or damage, and eggs coated with matter from broken ones may suffer injury if not cleaned.

Value of Cool Storage.

It may be mentioned that, during last season, over 11,000 dozen eggs were at the Export Depôt on behalf of various owners, with the result that all those treated under the above conditions were found perfectly sound and fresh at from four to nine months from date of storing. The advantages of storing is that when eggs are at their lowest they may be put away and kept until markets reach their highest, in April and May, when a profit of from 50 to 100 per cent. can be realised after paying all expenses.

Those intending to make use of the Export Stores during the coming season for storing eggs, are requested to supply early information as to their probable quantities, as it is anticipated that the space available will be fully occupied; and notice of early consignments is necessary, also, on account of the time required to properly regulate the temperature of the chambers.

Charges.

In order that small producers may have the benefit of the higher winter market, the charges have been fixed as low as possible, viz. :—

Receiving and delivering	... ...	3d. per case.
Storage per week	... ...	3d. ,,

These charges are payable on delivery, and include storage only; any cartage or carriage to or from stores must be paid by the owners.

Packing cases with fillers complete, may be purchased in Sydney at the cost of 2s. 6d. each.—By order, JAS. STEPHENSON, Secretary.

NOTE.—This means that eggs can be stored for eleven weeks at the cost of 1d. per dozen.

FATTENING SHEEP FOR FREEZING.

"MR. W. E. ABBOTT, of Wingen," reports the Singleton correspondent of the *Daily Telegraph*, "has been endeavouring to persuade the farmers of the Upper Hunter to embark upon the industry of fattening sheep, as is practised in the Canterbury Plains of New Zealand. He thinks this form of farming would be more remunerative than wheat culture and other branches of agriculture. Using the best of machinery to raise the crop, his experience of wheat-growing last year was that the cost of producing three bags of grain per acre was about 30s. There is the danger, too, in seasons which would produce a better crop, of the rust returning and ruining the industry entirely, as it did some years ago. During a visit to New Zealand some time ago, he obtained particulars of the sheep-feeding occupation of Canterbury Plains. It is there that the best sheep are raised for export. A comparison of the rainfall record was in favour of the Upper Hunter, so that the farmers here must have an advantage; while the climate was warmer, and the soil was equally fertile, if not more so. After four years of experimenting at Wingen, he found the raising of green crops to feed sheep was the most profitable form of farming. These included pumpkins, prairie grass, lucerne, and rape. The great advantage was that one man and his dog could harvest 10,000 acres, and there was no heavy cost of carriage to pay, as the sheep carried themselves to the nearest railway station or to the freezing works at Aberdeen. The result of the system in New Zealand was that practically all the fat sheep raised were produced by the small farmers. In a small place in the Canterbury district, he one day saw 16,000 store sheep sold in lots of 500 to the small farmers. The result of this important method of farming in New Zealand was that, although the whole colony only carried 18,000,000 sheep, she exported three times as much frozen mutton as New South Wales with 40,000,000. That was the whole secret of New Zealand being at present more prosperous than any of the other Australian colonies; for the man who exported was not the only person who profited by the undertaking, as the value of the exports came back in either money or goods, and all members of the commercial community benefited. Mr. Abbott's best record so far is eighteen sheep to the acre of rape, and these were sold as freezers at Aberdeen."

In connection with this matter, it may be mentioned that splendid crops of turnips, rape, mustard, and other suitable fodders have been obtained this season at the Hawkesbury Agricultural College, and a series of experiments are now in progress with hurdled sheep to demonstrate how profitably such a system as Mr. Abbott advocates can be carried out on even the poorer class of lands. Articles by Mr. Valder, and also by Mr. J. L. Thompson and Mr. Alex. Bruce, are in preparation. In the *Farmers and Fruit-growers' Guide*, Mr. Bruce describes the New Zealand methods, and points out how extensive is the area of this colony highly suitable for a system of agriculture, comprising the fattening of cross-bred sheep in the rotation of crops.

Milling Notes on the Lambrigg Harvest of 1897-98.

F. B. GUTHRIE AND E. H. GURNEY.

The wheats whose milling characteristics are presented in the following tables represented the more important and interesting of the varieties harvested last summer by Mr. Farrer, of Lambrigg, Queanbeyan.

They represent, of course, only a small proportion of the crosses made by Mr. Farrer, many being rejected by him for reasons other than their milling qualities, and many having been left unexamined owing to want of time and pressure of other work.

In order to do full justice to Mr. Farrer's work it would be necessary to examine, for their milling qualities, all the crossbred wheats and new varieties of any promise from a farmer's point of view. This would involve the examination of some hundreds of samples between the time of harvesting and the time of sowing for the next season. This is not possible under present conditions, and there may consequently be a considerable number of wheats desirable to the miller which have been overlooked.

The present batch of results will be of interest to those who have followed this work for two special reasons. In the first place, it represents very clearly the success Mr. Farrer is achieving in the breeding of strong-flour wheats suitable for growing in Australia. The wheats examined include a large number of crossbred wheats between strong-flour wheats on the one hand—which are often of low colour, and are too late for successful cultivation in the dry districts—and on the other wheats which possess good flour-colour and are early enough for our climate, but are generally of low strength. The batch named "Fife-Indians" are specially noteworthy in this connexion. The results are not strictly regular, but they show a very marked improvement in the matter of strength, and in many cases equal improvements in other good milling qualities. Mr. Farrer has at least a considerable number of fixed varieties which are of the highest value from a milling point of view, and as they have been selected with a special view to suit the local climate, there is every reason to hope that many, if not most of them, will give a good account of themselves in the different districts where they are now being tried.

If Mr. Farrer succeeds in finding half a dozen or so of these high-class strong-flour wheats which will suit the requirements of the different districts of the Colony, he will have done more than anyone

has yet thought possible. The second point of interest attaching to this batch of results lies in the fact that they are the first lot published (except some of those of typical wheats published in the *Agricultural Gazette* for May) which have been examined since the mills have been run by machinery.

On this account it will be as well to describe shortly the methods employed at present in the milling which supersede those published in the *Agricultural Gazette* of March, 1895. A description of the mill will be found in the *Agricultural Gazette* of July, 1898.

Details of the Method of Milling employed.

Cleaning the Grain.

About 1 lb. of grain is taken for milling. After a preliminary husking by beating in a bag, the sample is carefully cleaned by hand.

Weight per bushel.

The weight per bushel of the grain is obtained in the following way :—

A small glass jar with roughened edge, capable of holding exactly 8 oz. of distilled water when full, or $\frac{1}{160}$ part of a bushel (jar = about $3\frac{3}{4}$ inches in height, by $2\frac{3}{8}$ inches in diameter), is filled with grain from a funnel (dimensions of the funnel are—body of funnel = $6\frac{1}{4}$ inches diameter and $5\frac{1}{2}$ inches deep; neck of funnel = $\frac{13}{16}$ inch diameter and $3\frac{3}{4}$ inches long). The funnel is held at a uniform distance above the table, the end of the neck being $5\frac{1}{4}$ inches from bench. Of the cleaned grain, $7\frac{1}{2}$ oz. are run sharply from paper into the funnel, the lower end of which is closed with the hand. In running the grain from the paper to the funnel the paper is held just above the top edge of the funnel. By moving the hand the grain is allowed to run in and overflow the glass jar. The measure is then "striked" with one sweep of a broad, flat piece of wood and weighed. The operation is repeated half a dozen times and the average of the several weighings taken.

Conditioning.

One pound of grain is washed by rubbing the berries together on a sieve (fine enough to prevent loss of grain) under a stream of water, for about ten minutes.

The grain is then wiped rapidly with a perfectly clean cloth, and when dried placed in a small tin tray. The tray is then placed in a water-oven, and is prevented from touching the oven by two glass rods laid upon the bottom. The temperature is kept at about 35° to 40° C. The wheat is left in the oven for about fifteen minutes, or until it is so dry that it does not adhere to the hand when pressed upon it.

The milling.

(The figures refer to the sketch of the mill published in the *Gazette* of July, 1898.)

The conditioned wheat is now placed in the hopper of the rough-roller mill. The rolls are adjusted in this, the first break, so as to divide the grain a little more than in halves.

The product from this break passes down L on to a bran silk (24 grit-gauze), sketched on the frame, H.

The bran on this silk is thrown by the rotary motion of the bolting-box back to the cylinder, G.

The rolls are now tightened up for the second break, and the bran from G again placed in the hopper of the rough-roller mill, where it undergoes the same process as in the first break. When it has passed through, the rollers are again tightened for the third break, and the bran again taken from G.

This third break cleans the bran from flour sufficiently in many wheats, but if it is thought that more flour can be obtained from the the bran without affecting the colour of the flour it is put through a fourth break. This fourth break can be made with the rolls adjusted as in third break; but if it is necessary they may be tightened up a shade. The bran is now weighed and placed upon one side.

The flour which has passed through the silks during these breaks into the flour-tray, K, is also weighed and called "break flour." The percentage of "break flour" is given with the analysis of a wheat.

The frame, H, containing the bran silk is now removed and replaced by another frame containing the pollard silk (36 grit-gauze).

The break flour, after weighing, is put back into the flour-tray and the tray replaced in the bolting-box.

The smooth rolls are set going and the mill is ready for the reduction of the semolina.

The semolina is that portion of the wheat which has passed through the bran silk, and is collected by the rotary motion of the box in the inner cylinder, G.

After noting the colour and texture of the semolina it is put into the hopper of the smooth-roller mill.

The rolls being adjusted so as just to slightly crush the semolina, but it must *not* cake it.

After the first reduction the rolls are tightened slightly for the second reduction of the semolina. The process of reducing the semolina is similar to the "breaks" made upon the bran. After the second reduction the rolls are tightened for the third reduction.

This third reduction generally reduces the semolina sufficiently, though in some cases a fourth reduction is made by again tightening the rolls a shade.

The semolina has been reduced sufficiently when it is no longer sharp to the touch, and when it appears to contain no more flour.

The residue is now weighed as pollard, and the resulting flour in the flour-tray is also weighed.

The weights of the bran, pollard, and flour are now added together, and this is the total of products obtained; and from this total the individual percentages of bran, pollard, and flour are obtained.

The percentages are calculated from the products obtained, and not from weight of grain originally taken, as there is always a certain amount of loss in milling.

Examination of Flour.

The methods adopted for the determination of the colour, gluten-content, and strength of the flour are the same as already published. —*Agricultural Gazette*, March, 1895.

Explanation of the Tables.

Since this work was first taken in hand, the presentation of results has been considerably simplified, and, I hope, improved. Only those characteristics are taken into account which have a distinct bearing upon the value of the grain from a milling point of view.

A column has been added in which the characteristics have been summed up as briefly as possible, so that it is possible to tell at a glance the general behaviour of each sample in the mill.

Also a column translating the figures showing the "strength" of the flour into others showing the yield of bread in pounds. These figures showing the quantity of bread obtainable must be accepted with certain reservations. They are useful for the sake of comparison, and, I think, for that only. They are based on an arbitrary standard of consistency of the dough, whilst, as a matter of fact, some flours give better results when the dough is light, and others when it is heavy. Also each individual baker has a different opinion as to the best consistency for his dough.

Differences in the temperature of the oven are also not taken into account, nor the loss of water in baking, which varies with different temperature and with different flours. It has been assumed, in short, that the doughs are all of the same consistency, and are baked at the same temperature for the same length of time. It has been assumed that in all cases the dough in baking loses one-ninth of its weight.

The colour-scale has been abandoned, and an attempt has been made to describe the colours verbally. I am aware that this is very unsatisfactory, but we hope before long to be able to elaborate a more perfect method of referring the colours to a scale in such a way that it will be possible for anyone to reproduce for himself the actual colours obtained. It is of importance that a standard scheme of the kind should be introduced, as this work will very shortly be taken up in the other States. In Melbourne a similar mill is now being put up, and the South Australian Government has promised to erect one shortly in Adelaide.

It is therefore particularly important that the results should be so stated as to be easily verifiable by other workers.

Milling Notes on the Lambrigg Harvest of 1897–98.

(Those varieties marked with a * are either Lambrigg-made cross-breds or originated there.)

Variety of Grain.	Appearance of Grain—Size, Colour, Hardness.	Weight per bushel.	Percentage of Mill Products. Flour.	Pollard.	Bran.	Colour of Flour.	Percentage of Gluten in Flour.	Nature of Gluten.	Strength of Flour.	Bread in pounds from 200-lb. sack of flour.	Milling Notes.	General Characteristics.
* 1. Steinlee ..	Fair size, plump, white, soft.	62·5	75·0	14·7	10·3	Excellent, clear, good surface.	16·51	Soft, somewhat elastic, coherent, adhesive.	46·5	281	Bran and pollard, fairly clean; semolina, very slight yellowish tinge and slightly gritty 29·2 % break-flour.	Easy to mill; good-looking soft wheat, yielding plenty of flour of excellent colour and very high in gluten. Flour is, however, very weak.
* 2. Steinwedel x Steinlee.	Fair size, white, translucent, medium hardness.	63·6	70·5	19·1	10·4	Excellent, clear, good surface.	11·0	Soft, coherent, sticky.	47·2	282¾	Flour clings; bran, not very clean; pollard, clean; semolina, whitish and slightly gritty. 22·1 % break-flour.	Easy milling wheat, rather heavy, yielding readily fair percentage of flour of first-rate colour, but rather weak. Similar to No. 1.
* 3. Ranji ..	Fair size, dull colour, medium hardness.	60·9	75·6	10·7	13·7	Slightly yellow, clear, good surface.	17·30	Inelastic, medium-coherent, medium-adhesive.	40·0	280	Bran, fairly clean; pollard, clean; semolina, slight yellow tinge and slightly gritty. 31·7 % break-flour.	Easy to mill, yielding readily large percentage of flour. Flour remarkably high in gluten, but weak and of slightly yellow colour. High percentage of flour from breaks.
4. Purple Straw	Fair size, pinched, dull white, soft.	58·5	71·1	17·9	11·0	Slightly yellow, clear, good surface.	16·00	Soft, white, inelastic, coherent, adhesive, sticky.	45·6	279	Flour clings; flour, not very clean; pollard, very clean, semolina, whitish and very slightly gritty. 30·9 % break-flour.	Very easy to mill, rather light in weight, yielding fair quantity of a very weak flour. This sample differs from Purple Straw grown in other parts of the Colony by its exceptionally high gluten-content, which has caused the flour to be of a yellow colour.
* 5. Leakrigg x Mentor.	Fair size, pinched, dull white, medium hardness.	58·8	71·7	10·1	18·2	Yellow colour, good surface, but not clear.	17·08	White, soft, medium-elastic, very coherent, adhesive, sticky.	45·6	279	Bran and pollard, clean; semolina, slight yellow tinge and slightly gritty. 18·0 % break-flour.	Very similar in behaviour to No. 4; a weak flour remarkably high in gluten, and of yellow colour.
* 6. Jado ..	....	64·3	68·0	24·0	8·0	Good, clear, good surface.	13·23	Medium-coherent, medium-adhesive.	50·0	289	Bran, very clean; pollard, fairly clean.	Fair to mill, a heavy weight, yielding a flour rich in gluten and of good strength and colour.

7. Early Baart..	....	63·5	66·1	11·4	22·5	Whitish colour, fairly clear, good surface.	10·16	Coherent, soft, rather adhesive.	47·8	284	Bran, very hard to clean ; bran, dirty ; pollard clean.	The difficulty in cleaning the bran and the consequent low proportion of flour was due to the fact that this grain was milled when rather wet. The results are, therefore, hardly trustworthy.
* 8. Sweetheart	....	63·1	64·0	16·0	22·0	Slightly yellow, clear, good surface.	16·23	Coherent, not very elastic, soft, rather adhesive.	49·8	288½	Bran, very hard to clean ..	The same remarks apply as in the case of No. 7.
* 9. Trigger x Purple Straw.	Fair size, dark, translucent, rather soft.	62·0	70·8	8·8	20·4	Yellowish colour, clear, good surface.	16·61	Inelastic, coherent, adhesive.	49·0	286¾	Flour clings ; bran, not very clean ; pollard, clean ; semolina, slight yellow tinge and slightly gritty. 16·8 % break-flour.	Fair to mill, giving fair amount of flour of medium strength and very high gluten-content, to which is due the yellow colour of the flour.
10. White Lammas (grown at Wagga).	Fair size, white, soft.	59·7	71·3	11·7	17·0	Yellowish, clear, good surface.	16·43	Inelastic, non-coherent, adhesive.	45·0	277¼	Bran, fairly clean ; pollard, clean; semolina, very slight yellow and very slightly gritty. 25·9 % break-flour.	Easy milling wheat, flour rich in gluten, and slightly yellow in colour. Strength remarkably low for this variety. This wheat was perhaps a little dry when milled.
11. White Lammas (grown at Lambrigg)	Large, plump, dull, translucent, medium hardness.	62·9	70·8	12·0	17·2	Yellowish, clear, good surface.	15·36	Inelastic, non-coherent, adhesive.	50·0	289	Flour clings ; bran, not very clean ; pollard, fairly clean ; semolina, very slight yellow and very slightly gritty.	Easy milling wheat, yielding fair percentage of flour. Flour very high in gluten, of good strength, but slightly yellow in colour.
12. Nonpareil..	Fair size, plump, dull, translucent, medium hardness.	63·1	71·9	13·8	14·3	Yellowish, clear, good surface.	16·74	Inelastic, medium-coherent, non-adhesive.	46·6	281¼	Bran, fairly clean ; pollard, clean; semolina, slight yellow tinge and slightly gritty. 24·3 % break-flour.	Fairly heavy and easy milling wheat. Flour weak, and with yellowish tinge, and very high in gluten.
13. Australian Talavera.	Fair size, plump, dull, translucent, medium hardness.	62·6	68·7	12·7	18·6	Excellent, clear, good surface.	15·19	Soft, white, inelastic, non-coherent, medium-adhesive.	51·6	292½	Bran, not very clean ; flour, clings ; pollard, fairly clean ; semolina, slight yellow and slightly gritty. 17·6 % break-flour.	Fairly easy to mill. Flour of good strength, first-rate colour, and rich in gluten. Neither bran nor pollard were clean. A larger proportion of flour could doubtless have been obtained without detriment to its quality.
*14. Nutcut ..	Fair size, plump, dull white, soft.	63·0	69·0	18·8	12·2	Excellent, clear, good surface.	14·79	Medium-elastic, medium-coherent, slightly adhesive.	54·0	297¾	Flour, tendency to cling ; bran, not very clean ; pollard, fairly clean ; semolina, whitish and slightly gritty. 23·1 % break-flour.	Fair to mill. A strong flour-wheat, the flour being of excellent colour and surface, and rich in gluten. More flour could have been obtained here also without difficulty by a little closer milling.

MILLING NOTES ON THE LAMBRIGG HARVEST OF 1897–98—*continued.*

Variety of Grain.	Appearance of Grain—Size, Colour, Hardness.	Weight per bushel.	Percentage of Mill Products.			Colour of Flour.	Percentage of Gluten in Flour.	Nature of Gluten.	Strength of Flour.	Bread in pounds from 200-lb. sack of flour.	Milling Notes.	General Characteristics.
			Flour.	Pollard.	Bran.							
15. Tardent's Blue.	Fair size, plump, white, medium hardness.	62·1	68·0	12·5	19·5	Excellent, clear, good surface.	13·54	Fairly incoherent and elastic, not very adhesive.	49·6	288	Flour, clings somewhat; bran, fairly clean; pollard, clean.	Easy to mill; does not yield a very high proportion of flour. Flour of excellent colour, high in gluten, and fairly strong.
16. King's Jubilee.	Fair size, plump, white and dull, soft.	61·6	71·0	19·0	10·0	Whitish tinge, clear, good surface.	8·81	Soft, white, not very coherent, non-adhesive.	52·6	295¾	Flour, tendency to cling; bran and pollard, fairly clean; semolina, whitish and soft. 29·3 % break-flour.	Easy milling wheat; yielding readily flour of good quality as to strength and colour, but low in gluten. Good quantity of flour from break.
17. Zealand or Berthoud.	Fair size, dull white, medium hardness.	59·1	76·9	9·5	13·6	Very good colour and surface.	16·15	Inelastic, non-coherent, medium adhesive.	46·0	280	Bran, fairly clean; pollard, clean; semolina, slight yellow tinge and slightly gritty. 24·3 % break-flour.	Easy to mill; yielding large quantity of flour; rich in gluten and of good colour; rather weak; perhaps a stronger flour if the offal had been less well cleaned.
*18. Trenton ..	Fair size, dark, translucent, hard.	62·3	73·7	15·1	11·2	Yellow, and not clear, dirty.	17·12	Medium elastic, medium coherent, not very adhesive.	46·0	280	Bran, not very clean; pollard, clean; semolina, very slight yellow tinge and gritty. 23·4 % break-flour.	Fair to mill, yielding flour very rich in gluten, but of low colour and strength.
*19. Quail ..	Fair size, pinched, white, medium hardness.	56·4	72·0	17·3	10·7	Slightly yellow tinge, clear, good surface.	16·46	Soft, coherent, inelastic, adhesive.	46·2	280½	Flour clings; bran, not clean; pollard, clean; semolina, whitish and very slightly gritty.	Fair to mill; a light wheat, yielding a fair amount of flour of medium quality, high in gluten, and satisfactory in colour, but weak.
*20. Hermit....	Fair size, dull, medium hard.	59·7	68·1	15·8	16·1	Good colour, clear, good surface.	10·41	Hard, elastic, medium coherent, medium adhesive.	53·2	296¼	Attacked by weevil; bran, not very clean; pollard, clean; semolina, slightly yellow and gritty. 21·5 % break-flour.	Fair to mill; flour not plentiful, but of good colour and high strength. Probably with sound grain this variety would give excellent results.

21. White Russian.	....	61·6	70·4	16·8	12·8	Yellow tinge, clear, good surface.	17·04	Soft, white, inelastic, adhesive.	45·0	277¾	Bran and pollard, clean	A weak flour-wheat, but not starchy; very high gluten; not of best quality, and consequently weak. Colour good.
*22. Toby's Tusk	Fair size, medium hard.	60·9	73·6	8·7	17·7	Yellow tinge, clear, not very good surface.	14·58	Inelastic, non-coherent, medium adhesive.	46·8	281¼	Bran, not very clean; pollard, clean; semolina, yellowish tinge and slightly gritty. 15·3 % break-flour.	Easy to mill; plenty of flour of rather low strength, though high in gluten. Colour not quite satisfactory.
*23. Gatton ..	Fair size, plump, dull, translucent, medium hard.	62·5	74·3	10·6	15·1	Low colour, pinkish tinge when wet, brownish when dry.	13·83	Inelastic, coherent, adhesive, sticky.	47·6	283½	Bran and pollard, clean; semolina, very slightly yellow tinge and slightly gritty. 23·5 % break-flour.	Easy to mill; plenty of flour of somewhat inferior nature; colour unsatisfactory. Possibly this would have given better results if less severely milled.
*24. Blockhead	Fair size, plump, dull colour, medium hardness.	62·5	77·1	12·7	10·2	Bad colour, pinkish wet, brownish dry.	18·15	Soft, inelastic, coherent, adhesive, sticky.	44 0	275½	Bran, clean and very small; pollard, clean; semolina, very slightly yellow and slightly gritty. 20·7 % break-flour.	The amount of flour from this grain is so high, that it is very probable that better results would have been obtained if less severely treated. As it is the result is very disappointing.
25. Egyptian A.	....	59·2	71·0	21·0	8 0	Low colour, grey tinge, not good surface.	16·61	Soft, white, inelastic, adhesive.	45·2	278¼	Bran and pollard, clean	Flour of low quality, though very high in gluten.
*26. 14 (A) x Yandilla.	Fair size, plump, dull colour, medium hardness.	62·4	70·7	15·9	13·4	Slightly yellow tinge, clear, good surface.	16·44	Inelastic, medium coherent, adhesive.	48·0	284½	Bran, fairly clean; pollard, clean; semolina, yellowish tinge and gritty. 17·6 % break-flour.	Fair amount of flour of high gluten-content and fair strength; colour good, though slightly yellower in tinge than the best miller's flour.
*27. Maffra ..	Rather small, plump, dull, translucent, medium hardness.	62·3	70·8	11·4	17·8	Slightly yellow, clear, good surface.	13·28	Inelastic, very coherent, non-adhesive.	56·0	302¼	Bran, fairly clean; pollard, clean; semolina, yellowish tinge and gritty. 18·7 % break-flour.	A strong-flour wheat, yielding fair amount of good colour, high gluten-content, and very good strength.
*28. (Bellevue Talavera x Improved Fife x Blount's Lambrigg) x (Australian Talavera x Vanessa)	Medium size, plump, dull colour, medium hardness.	59·4	75·0	13·4	11·6	Colour poor and dirty.	18·00	Soft, medium elastic, coherent, adhesive.	48·5	285½	Bran, clean and small; pollard, clean; semolina, yellow tinge and slightly gritty. 22·1 % break-flour.	Remarkably high in gluten, and of good strength, but the very bad colour puts it out of court.

MILLING NOTES ON THE LAMBRIGG HARVEST OF 1897–98—*continued.*

Variety of Grain.	Appearance of Grain—Size, Colour, Hardness.	Weight per bushel.	Percentage of Mill Products.			Colour of Flour	Percentage of Gluten in Flour.	Nature of Gluten.	Strength of Flour.	Bread in pounds from 200-lb. sack of flour.	Milling Notes.	General Characteristics.
			Flour.	Pollard.	Bran.							
*29. bis ..	Fair size, long grain, white, soft.	58·4	75·0	14·0	11·0	Slightly yellow, clear, good surface.	13·55	Yellow, fairly elastic, slightly incoherent, very slightly adhesive.	44·0	275½	Flour clings; bran, fairly clean; pollard, very clean; semolina, slightly yellow tinge and very slightly gritty. 28·7 % break-flour.	Rather light wheat, but nevertheless yielding a remarkable high amount of flour with great ease. Flour unsatisfactory on account of its low strength, but otherwise of good colour and rich in gluten.
30. Allora Spring.	Small, plump translucent, medium hardness.	63·7	72·5	10·4	17·1	Slightly yellow, good surface, not very clear.	12·15	Medium, soft, white, fairly elastic, not very coherent, non-adhesive.	49·4	287½	Flour clings; bran small, not very clean; pollard, clean; semolina, slightly yellow tinge and slightly gritty. 15·2 % break-flour.	Heavy grain, yielding good quantity of flour of fair strength and gluten. Colour not entirely satisfactory on account of dullness.
*31. Carbine ..	Fair size, slightly pinched, dull colour, soft.	60·3	69·8	17·8	12·4	Yellow colour, clear, good surface.	14·44	Not very elastic, medium coherent, slightly adhesive.	46·8	281¼	Flour clings; bran, not clean; pollard, clean; semolina, very slightly yellow and very slightly gritty. 30·5 % break-flour.	Medium yield of flour of medium quality; colour distinctly yellow.
*32. F (1) x Indian B.	Long, pinched, dull white, medium hardness.	61·4	71·4	14·3	14·3	Excellent, clear, good surface.	13·45	White, soft, elastic, coherent, very adhesive.	44·2	276	Flour clings; bran, not clean; pollard, fairly clean; semolina, whitish and slightly gritty. 25 % break-flour.	Fair yield of flour of excellent quality except for low strength
33. Howra ..	Long, fair size, dark, translucent, hard.	62·0	70·3	20·2	9·5	Bright yellow colour, good surface.	14·26	Inelastic, very soft, coherent, very adhesive.	45·6	279	Bran, clean and small; pollard, fairly clean; semolina, rich yellow, very gritty.	Unsatisfactory on account of the semolina being difficult to reduce, and of weakness of resultant flour. Colour, though yellow, is very clear, and surface good. Loaf should not be coloured.
4. Bald Ferozapore—white.	Medium size, white, soft.	65·9	72·7	15·2	12·0	Yellow tinge ..	13·62	Soft, slightly adhesive.	47·4	283	Flour clings; bran, not very clean; pollard, clean; semolina, white, not gritty.	Very heavy wheat; good yield of flour, not very strong, and yellow in colour.

Indian Wheats.

35. Bald Canning Downs.	Fair size, white, medium hardness.	65·4	72·3	17·7	10·0	Yellowish tinge.	12·60	Medium elastic, medium coherent.	51·6	$292\frac{1}{4}$	Flour clings; bran, not very clean; pollard, fairly clean; semolina, slightly yellow tinge and slightly gritty. 26·5 % break-flour.	Heavy grain, yielding good proportion of excellent flour; strong, of good colour, though slightly yellow and rich in gluten.
36. Bald Daman	Fair size, plump, very well filled, dark, translucent, hard.	66·4	73·9	13·6	12·5	Yellowish colour, clear, good surface.	11·76	Elastic, incoherent.	52·2	294	Bran, clean; pollard, clean; semolina, slightly yellowish tinge and gritty. 13 % break-flour.	Very heavy grain; high percentage of excellent flour, of good strength, fair gluten content, though slightly yellow in colour.
37. Muzaffar Nagar Bearded White.	Large, plump, translucent, medium hardness.	65·7	71·0	19·6	9·4	Yellowish tinge.	13·72	Inelastic, incoherent, not adhesive.	51·2	$291\frac{3}{4}$	Flour clings; bran, fairly clean; pollard, clean; semolina, white and slightly gritty. 18 % break-flour.	Heavy grain, very similar to 36.
38. Pitsi Ekdam	Large, plump, dull, translucent, medium hardness.	63·9	69·5	15·5	15·0	Excellent, clear, good surface.	12·94	Soft, slightly adhesive.	47·4	283	Flour clings; bran, not clean; pollard, clean; semolina, white and slightly gritty. 19 % break-flour.	Heavy grain, yielding fair proportion of excellent flour, not so strong as most of the Indians, but of exceptionally good colour.
39. Buxar ..	Fair size, plump, translucent, hard.	65·0	69·0	20·1	10·9	Yellow tinge ..	14·25	Fairly elastic, medium coherent, slightly adhesive.	48·0	$284\frac{1}{2}$	Flour clings; bran and pollard, not very clean; semolina, slight yellow tinge and slightly gritty. 20 % break-flour.	Heavy grain, similar to 38, though less satisfactory in point of colour.
40. Muzaffar Nagar Red.	Fair size, dark, reddish, translucent, hard.	65·6	69·5	15·2	15·3	Yellow tinge ..	13·76	Elastic, medium coherent.	52·4	$294\frac{1}{2}$	Flour clings slightly; bran, fairly clean; pollard, clean; semolina, yellowish tinge and gritty. 10 % break-flour.	Heavy grain, yielding a strong flour, rich in gluten and of satisfactory colour, though slightly yellow.
41. Mooltan Hard.	Fair size, plump, translucent, hard.	66·6	71·6	15·8	12·6	Good colour and surface.	12·44	Soft, coherent, slightly adhesive.	48·6	$285\frac{3}{4}$	Bran, clean and very small; pollard, clean; semolina, yellowish tinge and gritty. 9 % break-flour.	Very heavy grain, yielding good proportion of excellent flour, of medium strength, though somewhat lower than most of the Indians, but of good colour and rich in gluten.
42. Etawah ..	Fair size, translucent, hard.	66·0	74·5	14·7	10·8	Yellow tinge ..	12·53	Elastic, not very coherent, toughish.	53·2	$296\frac{1}{4}$	Bran, not very clean; pollard, clean; semolina, yellowish and gritty. 14 % break-flour.	Very heavy grain, yielding abundantly flour of high strength and rich in gluten; colour good, though slightly yellow.
43. Muzaffar Nagar Bald White.	Fair size, translucent, hard.	65·1	71·2	16·0	12·8	Bright yellow colour, good surface.	15·5	Inelastic, incoherent, non-adhesive.	62·8	$317\frac{1}{4}$	Bran, clean and small; pollard, fairly clean; semolina, rich yellow, and gritty. 10 % break-flour.	A very heavy wheat, yielding a very strong flour of very high gluten-content; the colour is defective, being yellow, but is bright and of good surface, and would give clean loaf. Very little break-flour.

MILLING NOTES ON THE LAMBRIGG HARVEST OF 1897–98—*continued.*

	Variety of Grain.	Appearance of Grain—Size, Colour, Hardness.	Weight per bushel.	Percentage of Mill Products. Flour.	Pollard.	Bran.	Colour of Flour.	Percentage of Gluten in Flour.	Nature of Gluten.	Strength of Flour.	Bread in pounds from 200-lb. sack of flour.	Milling Notes.	General Characteristics.
Indian Wheats	44. Indian D. ..	Fair size, dull, white, hard.	64·3	70·4	9·6	20·0	Very good, clear, good surface.	10·35	Inelastic, very non-coherent, non-adhesive.	58·6	308	Bran, not very clean; pollard, clean; semolina, yellowish and gritty. 26 % break-flour.	This is a fine wheat, yielding a fairly good proportion of strong flour, of excellent colour and surface.
Fife-Indian Wheats	*45. Yandilla x Etawah.	Plump grain, translucent, hard.	65·9	71·9	11·1	17·0	Yellow tinge, clear.	13·40	Medium soft, incoherent, non-adhesive.	56·0	303¼	Bran, clean and very small; pollard, fairly clean; semolina, rich yellow tinge, and very gritty. 10·5 % break-flour.	Very heavy grain, yielding strong flour with slightly yellow tinge, rich in gluten. Semolinas remarkably hard and difficult to reduce.
	*46. Yandilla (Improved Fife x Etawah).	Small, very plump, translucent, hard.	65·3	73·2	8·1	18·1	Yellow tinge ..	15·97	Soft, white, coherent, slightly adhesive.	50·6	287½	Bran, clean; pollard, not very clean; semolina, yellowish and gritty, rather hard to reduce.	Similar grain to 45; flour not so strong.
	*47. Warner ..	Fair size, white, medium hardness.	62·7	73·4	18·3	8·3	Very good, clear, good surface.	15 26	Elastic, not very coherent, non-adhesive.	55·8	301¾	Bran, fairly clean; pollard, clean; semolina, whitish and gritty. 23 % break-flour.	A strong-flour wheat, rich in gluten and of excellent colour; the yellow colour of the semolina of the Indian wheats is less noticeable in this and the two following.
	*48. Willow ..	Fair size, pinched, dull, white, medium hardness.	59·4	71·6	13·1	15·3	Yellow tinge, fair surface, not clear.	12·68	Inelastic, very non-coherent, non-adhesive.	63·4	318¾	Bran, small and clean; pollard, fairly clean; semolina, whitish and gritty. 12 % break-flour.	Very strong flour, of good colour, but not of very good texture; this defect might be improved by different dressing.
	*49. Hayrick ..	Rather large, dull, translucent, hard.	60·3	71·3	19·1	9·6	Very good, clear, good surface.	14·69	Elastic, non-coherent, non-adhesive.	53 6	297	Bran and pollard, fairly clean; semolina, whitish and slightly gritty. 14·5 % break-flour.	Flour rich in gluten and of first-rate colour, but less strong than 48, though much above average strength.
	*50. Ruskin ..	Fair size, plump, dull, translucent, hard.	61·3	74·5	11·0	14·5	Yellow tinge, good surface.	13·57	Elastic, fairly incoherent, not very adhesive.	49·2	287¼	Bran and pollard, clean; semolina, yellowish tinge and gritty.	Yields flour readily, of good colour and high gluten, but of only medium strength.

Fife-Indian Wheats.	*51. Purple Stem	Fair size, translucent, hard.	63·0	74·2	13·4	12·4	Yellow tint, clear, good surface.	16·34	White, very soft, coherent, sticky.	49·4	287½	Bran, fairly clean; pollard, clean; semolina, slight yellowish tinge, and very gritty.	Flour yielded readily; very high in gluten and of good colour, but only average strength; mills like a soft wheat, except for grittiness of semolina.
	*52. Langshan ..	Fair size, dull, medium hardness.	62·3	75·6	15·4	9·0	Yellow tint clear, good surface.	15·65	Soft, medium, incoherent, slightly adhesive.	52·2	294	Bran and pollard, clean; semolina, yellowish tinge and gritty.	Yields good quantity of flour, of good colour and strength, and high in gluten.
	*53. Warren ..	Fair size, white and soft.	64·2	72·1	11·8	16·1	Very good colour, clear, good surface.	13·25	Soft, inelastic, adhesive.	45.0	277¼	Flour clings slightly; bran, not very clean; pollard, fairly clean; semolina, slight yellowish tinge, and slightly gritty. 29 7 % break-flour.	Heavy wheat, with good yield of flour of first rate colour and rich in gluten. Very disappointing in the matter of strength, the lowness of which is remarkable in such a cross.
	*54. Kirby ..	Fair size, dull white, medium hardness.	63·8	69·0	20·0	10·1	Yellowish, clear, good surface.	14·78	Rather incoherent, non-adhesive.	56·2	302¾	Flour clings; bran and pollard, not very clean; semolina, yellowish and gritty. 30·8 % break-flour.	A heavy strong-flour wheat, yielding flour of good strength and colour and high in gluten. In fact, a good flour above the average.
	*55. Come-back	Fair size, plump, translucent, hard.	62·0	72·0	12·0	10·0	Excellent, clear, good surface.	13·60	Elastic, soft, fairly coherent, non-adhesive.	62·0	315½	Bran, fairly clean; pollard, clean; semolina, whitish tinge and gritty.	One of the most satisfactory of the series, yielding a fair amount of flour of very high quality in all respects, being very strong, rich in gluten, and of excellent colour.
	*56. Jonathan ..	Fair size, dull, translucent, hard.	62·9	70·5	20·8	8·7	Excellent colour, clear, good surface.	14·46	Incoherent, non-adhesive.	68·0	320	Bran and pollard, fairly clean; semolina, slight yellowish tinge, and gritty. 15·7 % break-flour.	Similar to 55, and, if anything, a better flour, being of remarkable strength. The flour is a little more difficult to obtain than in 55.
	*57. Lancer ..	Large grain, pinched, dull colour, medium hardness.	62·6	75·2	16·0	8·8	Yellowish, clear, good surface.	16·23	Hard, medium elastic, non-coherent, non-adhesive.	63·2	318¼	Bran and pollard, clean; semolina, whitish and gritty. 24 % break-flour.	Very strong-flour wheat; very high in gluten; colour slightly yellow, due to high gluten. Yields flour fairly readily. Fairly high percentage of break-flour.
Sports from Blount's Lambrigg.	*58. A (F) ..	Small, plump, dull, medium hardness.	62·7	69·5	16·7	13·8	Yellowish, clear, good surface.	16·74	White, soft, medium elastic, medium adhesive.	47·8	284	Bran and pollard, fairly clean; semolina, whitish and gritty.	Flour very high in gluten, but only of moderate strength; colour good but slightly yellow.
	*59. C (F)	Fair size, plump, dull white, rather soft.	58·3	71·2	16·7	12·1	Very good colour, clear, good surface.	13·56	Soft, medium coherent, slightly adhesive.	50·8	290¾	Flour clings slightly; bran, not very clean; pollard, clean; semolina, whitish and gritty.	Not a heavy wheat, yielding readily fair quantity of excellent flour, of average strength, and of very good colour, and high in gluten.

D

MILLING NOTES ON THE LAMBRIGG HARVEST OF 1897–8—*continued.*

Variety of Grain.	Appearance of Grain. Size, Colour, Hardness.	Weight per bushel.	Percentage of Mill Products.			Colour of Flour.	Percentage of Gluten in Flour.	Nature of Gluten.	Strength of Flour.	Bread in pounds from 200-lb. sack of flour.	Milling Notes.	General Characteristics.
			Flour.	Pollard.	Bran.							
*60. G (F) ..	Small, plump, dark, translucent, hard.	62·4	71·0	13·0	16·0	Yellowish, clear, good surface.	15·16	Soft, not very coherent, elastic, not very adhesive.	56·0	302½	Bran, clean; pollard, fairly clean; semolina, whitish and gritty. 21·5 % break-flour.	Fairly heavy wheat, yielding strong flour rich in gluten, but of slightly yellow tint.
*61. H (F) ..	Small, plump, dull, hard.	62·6	70·6	10·9	18·5	Yellowish, fair surface, not very clear.	15·21	Fairly elastic, fairly coherent, non-adhesive.	53·6	297	Bran, not very clean; pollard, fairly clean; semolina, whitish and gritty. 13·3 % break-flour.	Flour is of moderately high strength and rich in gluten, but colour is not first-class; offal rather hard to clean.
*62. L (F) ..	Small, very plump, dark, translucent, hard.	63·9	75·2	17·1	7·7	Dirty colour, not clear.	15·86	Soft, coherent, adhesive.	52·0	293½	Bran, clean and very small; pollard, clean; semolina, slight yellow tinge, and very gritty.	This wheat was probably over-milled, or milled too dry, so that bran was chopped small. The bad colour of the flour is particularly disappointing, and may be due to over-milling.
*63. M (F) ..	Small, plump, dark, translucent, hard.	64·5	71·7	19·0	9·3	Greyish tinge, not very clear.	12·87	Elastic, rather incoherent, non-adhesive.	54·8	299½	Bran, small and clean; pollard, fairly clean; semolina, very slight yellow, and gritty. 15 % break-flour.	Though a heavy grain, flour is not remarkable either in quantity or quality; strength fairly high, and gluten good colour grayish and unsatisfactory.
*64. N (F) ..	Small, plump, dark, translucent, hard.	63·2	74·0	11·6	14·4	Yellowish, clear, good surface.	13·75	Coherent, inelastic, slightly adhesive.	48·0	284½	Bran, small and fairly clean; pollard, clean; semolina, slight yellow, and gritty. 16·8 % break-flour. Sample was slightly over-milled.	Fairly heavy wheat, yielding high percentage of flour of fairly good quality; rather weak for this cross.
*65. P (F) ..	Fair size, dull, hard.	60·3	74·7	11·9	13·4	Reddish colour, not clear.	15·15	Hard, medium elastic, non-coherent, non-adhesive.	68·0	329	Bran and pollard, clean; semolina, yellowish tinge and very gritty. 18 % break-flour.	Yields readily high proportion of remarkably strong flour; very rich in gluten, having unfortunately the defect of a somewhat reddish colour.
*66. Q (F) ..	Small, plump, dark coloured, medium hardness.	61·8	68·0	18·0	14·0	Yellowish, clear, good surface.	15·56	Inelastic, coherent, rather adhesive.	51·4	292	Bran, not very clean; pollard, clean; semolina, slight yellowish tinge and gritty. 11·6 % break-flour.	Fairly strong flour-wheat; very rich in gluten, and of yellow colour; offal difficult to reduce; and yield of flour rather low.

Sports from Blount's Lambrigg.

	*67. S (F) ..	Small, plump, dark, translucent, hard.	63·5	68·5	16·3	15·2	Yellowish, clear, good surface.	15·21	Medium elastic, medium coherent, not very adhesive.	54·8	300	Bran, not very clean; pollard, fairly clean; semolina, whitish and gritty. 16·2 % break-flour.	Similar to 66.
Fife wheats.	68. Improved Fife.	Fair size, pinched, dull white, medium hardness.	..	72·9	18 1	9 0	Rather dark ..	15·29	Soft, incoherent	58 2	307½	Bran cleans easily; bran, clean; pollard, very clean; semolina, whitish and gritty.	The colour is darker than in samples of this variety previously examined, which were yellowish. Both this and Hornblende were probably overmilled, the bran being very small and in small quantity.
Fife wheats.	69. Hornblende	Fair size, dull, translucent, medium hardness.	57 0	67·6	27·7	4·7	Rather dark, not very clear.	18·29	Soft, white, medium coherent, not very sticky.	56·8	304¼	Bran cleans easily; bran, not very clean; pollard, clean; semolina, whitish and gritty. Very little bran — perhaps over-milled.	Same remarks apply as to 68, though the grain is very light in weight and not of high quality. The flour is remarkably high in gluten, which has no doubt affected the colour.
A series containing Sicilian square-headed red and Hornblende in varying proportions.	*70. Sinew x (Improved Fife x Vilmorin's Indian).	Fair size, white, medium hardness.	56·3	64·1	17·8	18·1	Yellowish, fairly clear, bad colour, with pinkish tinge.	15 07	Soft, rather coherent.	49·6	288	Flour clings; bran, dirty; pollard, clean; semolina, slight yellow and gritty.	Light grain, small proportion of flour, of poor colour, high gluten of average strength.
A series containing Sicilian square-headed red and Hornblende in varying proportions.	*71. Palmerston x Improved Fife.	Fair size, dull colour, fairly hard.	..	70 7	19·6	9·7	Dark colour ..	17·58	Soft, white, inelastic, fairly coherent, sticky.	55·0	300¼	Bran cleans easily; bran and pollard clean; semolina, whitish and gritty.	Flour of good strength but of very bad colour; gluten remarkably high.
A series containing Sicilian square-headed red and Hornblende in varying proportions.	*72. Samson x (Improved Fife x Hussar).	Fair size, dull colour, medium hardness.	60·0	68·6	12·8	18·6	Good colour, good surface, clear.	14·53	White, fairly tough, slightly incoherent, not sticky.	57·2	335¼	Bran and pollard, clean; semolina, yellowish tinge and gritty.	This is the most satisfactory of the series, 69–71, and is the only one in which the colour is first rate The strength is also the highest, flour yield good, and gluten high.
A series containing Sicilian square-headed red and Hornblende in varying proportions.	*73. Samson ..	Fair size, dull colour, fairly hard.	..	71·3	22·0	6·7	Dark colour ..	16·8	Soft, yellowish, inelastic, fair, coherent, sticky.	52·4	291½	Bran cleans fairly easily; bran and pollard, clean; semolina, slight yellow and gritty.	Good, except for dark colour of flour, strength fairly good and gluten high. Bran very small in amount.
A series containing Sicilian square-headed red and Hornblende in varying proportions.	74. Sicilian square-headed red.	Fair size, dull reddish, fairly hard.	..	67·2	17·3	15·5	Dark colour ..	14·52	Very soft, yellow, inelastic, coherent, very sticky.	41 6	276¼	Bran cleans easily; bran and pollard, clean; semolina, yellow tinge and gritty.	Flour small in quantity and difficult to obtain; flour rich in gluten, but of low strength and bad colour.

The following notes, kindly supplied by Mr. Farrer, are explanatory of the names of the new crosses, and show the parentage of the different varieties recorded in the table :—

1. Steinlee = Steinwedel × King's Jubilee.

3. Ranji = Steinwedel × Indian King.
Indian King = King's Jubilee × Indian A.

5. Leakrigg = Leak's RR × Blount's Lambrigg.
Mentor = Ploughboy × Holdfast.
Ploughboy = Steinwedel × Amethyst (a Fife wheat).
Holdfast = King's Jubilee × Ward's Prolific.

6. Jade = Jacinth × Early Baart.

8. Sweetheart = Blount's Lambrigg × (White Cythere × Yeoman).
Yeoman = Hornblende × Ward's Prolific.

9. Trigger = Purple Straw × Yeoman.

10 and 11 are apparently somewhat widely differing strains of the same variety ; 10 was manured with Sugar Company's No. 1 superphosphate.

12. Nonpareil. This grain came from South Australia, and is quite different from the variety which has been going under the same name in this Colony. The South Australian is apparently the better wheat.

13. This is probably not identical with the variety being grown under this name, for the latter has been found to be made up of two different wheats. The wheat examined is probably identical with one of these two.

14. Nutcut = Australian Talavera × (Blount's Lambrigg × Indian G).

15. Tardent's Blue. This variety was brought some years ago to Queensland by Mr. Tardent from the country of the Lower Danube.

17 was manured with Sugar Company's No. 1 superphosphate.

18. Trenton = Levelhead × Berthond.
Levelhead = Hornblende × Blount's Lambrigg.

19. Quail = Australian Club × (Australian Talavera × Vanessa).
Vanessa = Hornblende × Indian A.

20. Hermit = Rocket × Sport "B," from Hornblende.
Rocket = Steinwedel × (Amethyst × Hornblende).

22. Toby's Tusk = Toby × Free-trade.
Free-trade = Blockhead × King's Jubilee.
Blockhead = Toby × Blount's Lambrigg.

23. Gatton = Blockhead × Free-trade.

26. 14 (A) = Purple Straw (almost certainly).
Yandilla = Improved Fife × Etawah (an Indian wheat).

27. Maffra = (Blount's Lambrigg × Hornblende) × King's Jubilee.

29. Ibis = Hawker × Indian King.
Hawker = Marshall's No. 3 × Ward's Prolific.
Indian King = King's Jubilee × Indian A.

31. Carbine = (Blount's Lambrigg × Ward's Prolific) × Indian G.

33-44 inclusive are Indian varieties. In the case of Nos. 33, 37, 38, 39, 40, and 43, the grain which was milled was of the first generation grown in this country. Some of the imported grain of varieties 37, 38, 39, 43 was also milled, and the results given in *Agricultural Gazette*, vol. , page . The differences in the results obtained from the imported grain and the grain grown at Lambrigg of these varieties are so striking as to deserve attention.

43 has since been found to consist of two varieties mixed. These have been grown separately, and the results of both should be obtained next year.

45–57 are Fife-Indian wheats—that is to say, they are the results of crosses between varieties of the strong-flour Fife family of wheats (which are so largely grown in Manitoba and Minnesota) on the one hand, and selected strong-flour Indian varieties on the other. These Fife-Indian wheats have been made for the purpose of getting varieties with all the good qualities of the famed strong-flour Manitoba and Minnesota (Duluth) wheats, and early enough to be suitable for the warmer districts of Australia. The attempt appears not to have been unsuccessful, as a comparison of the results given in the mill by No. 56 (Jonathan) with those given by Nos. 68 and 69 (which are pure Fifes) will show; indeed, the strongest-flour pure Fife wheat which has yet been examined is Hornblende, grown at Lambrigg in 1893, and it only showed a flour-strength of 63·9, which corresponds to about 319¾ lb. of bread from a 200-lb. sack of flour. Of these Fife-Indian wheats, Nos. 47, 48, 49, 50, and 53 contain a dash of Ward's Prolific blood, which was given for the purpose of increasing their rust-resistance. The undesirable effects of even a slight dash of the blood of this variety will be noticed.

58–67 inclusive originated from a single plant which appeared in 1894 amongst Blount's Lambrigg. The differences in the milling qualities of these wheats are remarkable.

70. Sinew = Sicilian square-headed Red × Hornblende.

71. Palmerston = Samson × Statesmen.
Samson = Sinew × Improved Fife.
Statesmen = Hornblende × Yeoman.
Yeoman = Hornblende × Ward's Prolific.

72. Hussar = Hornblende × Indian G.

74. Sicilian square-headed Red is a highly rust-resistant variety, and produces grain which is rich in gluten, but the gluten is of a dark-yellow colour, and of very poor quality.

Notes to the Tables.

The most striking feature in the present batch of results is the high percentage of gluten in the flour. This increase in gluten has been associated with weaker flour-strength.

Mr. Farrer says that the wheats were all manured with sulphate of ammonia and bone-dust, and it is possible that this excessively nitrogenous manuring may have been responsible for this result.

Some of these differences are very striking; for instance, in the Indian-grown wheats. Some of these were examined in 1896. They were grown in India and imported. The difference between the glutens and strength of these wheats and the same grain after being grown at Lambrigg is shown in the following table:—

	Imported grain.		Same grain. Grown at Lambrigg.	
	Gluten.	Strength.	Gluten.	Strength.
Pitsi Ekdam	9·61	50·8	12·94	47·4
Muzaffar Nagar (Bald White) ...	10·29	61·2	15·50	62·8
,, (Bearded White)	6·07	57·0	13·72	51·2
Buxar	7·24	55·2	14·25	48·0

In the same way the sample of Purple Straw is extraordinarily high in gluten for this variety, previous samples which have been examined never going above 9 or 10 per cent., and being usually between 8 and 9.

An increase in the gluten-content is generally associated with a yellower or even darker colour of the flour, and there is no doubt that the greatly increased gluten has had a detrimental effect upon the colours of most of the samples here recorded. This would be particularly the case with wheats which do not yield their flour readily, and where the bran requires more than ordinary cleaning.

Fife-Indian Wheats.

(Note by MR. FARRER.)

Some notes in regard to the new Fife-Indian wheats may not be out of place here. These wheats, as has already been mentioned, have been made by mating varieties of the Fife family of wheats, which are so generally grown in Manitoba and Minnesota (Duluth), with selected Indian varieties, and contain the bloods of these wheats in different proportions, the blood of the Fifes generally preponderating. The special merits of Indian wheats are earliness and ability to hold their grain firmly; while their faults are in general too slender and weak straw and a too dwarf habit of growth. The Fife-Indian wheats may therefore be expected to show the Indian blood they contain by both the faulty and the strong points of these wheats. In fixing varieties from crossbreds of Fife-Indian parentage, my aim has been to retain as far as possible, by means of selection, the merits of the Indians, and to get rid of their defects, and especially of their weakness of straw, which I regard as the more serious. In some cases I have only been able to get rid of this fault, and to get plants which stand up sufficiently well to be harvested by machinery, by retaining a comparatively dwarf habit. The Fife-Indians then, as a class, differ from the Fifes in being earlier, in holding their grain more firmly (the pure Fifes are too apt to shell), and, in a less degree, in having straw which is slenderer, shorter, and produced in less abundance. Of the varieties which are included in the above list, Jonathan, Come-back, and Kirby are the most promising for practical cultivation, and are not unlikely to become standard varieties. Owing to the fact that the present season is the first time they have been planted at the Experiment Farms, and that there are several strains of each which are not unlikely to differ appreciably in milling excellence, as well as in suitability for the different districts of the Colony, and that it is desirable that we should first get a knowledge of these differences, it will in all probability be at least two years before even small quantities of them will be available for distribution for purposes of trial, and another year before they can be produced in quantity for sale at the Experiment Farms.

The Best Bee Quilt.

Speaking about bee quilts, Mr. C. W. R. Parker, of Durren Durren, says he has always found a piece of good corn-bag the most suitable material for either summer or winter use. He has tried American cloth of all qualities, but discarded it over four years ago in favour of corn-bagging, which is very seldom gnawed through, and is a great preventive of damp and mould in the hive.

Formulæ for Preparing Fertilisers.

F. B. GUTHRIE.

For Grape-vines.

No. 10.

	Quantity per half-ton.	Cost. £ s. d.
Sulphate of ammonia	400 lb.	1 16 0
Superphosphate	470 lb.	1 1 0
Sulphate of potash	250 lb.	1 13 9
	10 cwt.	£4 10 9

This will contain—

Nitrogen ... = 8 per cent.
Phosphoric acid = 8 per cent.
Potash ... = 12½ per cent.

This should be applied at the rate of 5 cwt. to the acre, and will cost about £2 5s. per acre.

This will provide—

40 lb. nitrogen ...
40 lb. phosphoric acid } per acre.
62 lb. potash ...

The grape-vine is a more exhausting crop than the other fruit-trees, and requires a larger proportion of manure.

It is particularly exhaustive of nitrogen, potash, and lime, the phosphoric acid being of minor importance. There is not the danger of supplying excessive nitrogen, as is the case with some of the other fruits, and the nitrogenous manuring should be pretty heavy.

The above formula is for soil well supplied with lime or well limed. Liming is essential, but if the soil is deficient this should be supplied with the manure. Sulphate of lime is usually recommended for this purpose, and the following formula gives the necessary alterations:—

No. 11.

On Soils poor in Lime.

	Quantity per half-ton.	Cost. £ s. d.
Sulphate of ammonia	370 lb.	1 13 0
Sulphate of potash	200 lb.	1 7 0
Superphosphate	200 lb.	0 8 6
Gypsum	350 lb.	0 6 0
	10 cwt.	£3 14 6

This will provide a manure containing—

Nitrogen ... = 7⅓ per cent.
Phosphoric acid = 3½ per cent.
Potash ... = 10 per cent.
Lime ... ... = 10½ per cent.

and, applied at the rate of 6 cwt. per acre, will give the vines a dressing of—

45 lb. nitrogen ...	per acre.
21 lb. phosphoric acid	
60 lb. potash ...	
63 lb. lime	

at a cost of £2 5s. per acre.

(*To be continued.*)

A Caterpillar Plague.

In consequence of the number of reports received by the Department of the destruction caused by the caterpillars in the Narrabri and Gunnedah districts, Mr. W. W. Froggatt, the Government Entomologist, was instructed to visit the infested localities by the Minister (Hon. J. Cook), and report upon them, investigate the habits of the insects and their distribution, and suggest remedies and preventives to those interested. He found their most northern limit about 20 miles north of Narrabri. Eastward they have been very destructive around Manilla, and southward to below Breeza, and are also very destructive round Warren. They are doing most of the damage in the black soil country, upon which the eggs from which they were produced have been deposited, but do not go near the red soil plains and ridges; so that, looking over an infested district, all the black soil looks as if it had been ploughed, while the red soil stands out bright and green. Thousands of acres of grass and hundreds of acres of young crops have been swept off as clean as if they had been burnt, not even a Scotch thistle being left behind. Both at Boggabri and Gunnedah, Mr. Froggatt found that the caterpillars are being attacked by a fungoid disease that appears to be spreading so rapidly that hardly one will ever reach maturity. The ground in places was covered with dead and dying caterpillars, the sick ones eating the dead ones, and where stones or growing shrubs were to be seen they were festooned with dead caterpillars, stiff, and extended to their full length, with the white spores of the fungus sprouting out along the sides of the body. These caterpillars are the larvæ of a stout, thick-set, dark-coloured, noctuid moth (Agrotis sp.), and any caterpillar reaching maturity would bury itself in the ground some few inches below the surface, change into a chrysalid, and emerge as a perfect moth towards the end of October, ready to lay about 500 eggs. Farmers have been rolling their crop paddocks invaded by the caterpillars with good results, as it not only kills great numbers if done when they are feeding, but closes up the cracks in the soil, and prevents those left from eating down the wheat stalks. A deep-cut plough furrow around a paddock will sometimes divert them from their line of march. Spraying the headland or outer strip of the crop with Paris green before they reach it would also kill all eating the poisoned plants. When they are on the edge of the hard ground, a mob of sheep driven along their track would kill an immense number.

Soil Analysis and its Value.

At the fifteenth of the series of monthly readings organised by the Hunter River Agricultural Society at West Maitland, Mr. F. B. Guthrie, Chemist to the Department, lectured on "Soil Analysis and its value to the Farmer."

Mr. Guthrie said that when he was invited by the Association to deliver a lecture on the subject of soil analysis, he was afraid that the subject being of an essentially scientific and extremely technical nature, it would not be possible to make it as interesting as other branches of agriculture might be made. He had therefore decided to explain to them, to the best of his ability, a few of the simplest methods of interpreting soil analysis, so that the farmer could use them, and apply the knowledge thus obtained to the manipulation of his soil afterwards. There were some people, no doubt, who relied too much on what soil analysis could do for them. They thought that if certain ingredients which the soil lacked were added the result would be satisfactory. To a certain extent that was so, but the nature and texture of the soil must also be taken into account. There was no doubt, however, that when properly interpreted, soil analysis would be of considerable benefit to the practical farmer. He had been engaged in the Department of Agriculture almost since its initiation, and he knew many farmers who had benefited by the information obtained by having their soil analysed, and he did not know one that had cause to regret having done so. Soil analysis could give the farmer certain definite information. It would tell him how to manipulate his land to retain moisture so as to resist drought. It would enable him to determine with certainty whether any particular soil was in good mechanical as well as chemical condition; whether sand, clay, and humus were in proper proportions; whether it was likely to resist drought; whether it was "sour" and why; whether it contained a sufficiency of plant-food, and whether it held deleterious substances, such as salt and alkalies. It would not only do this but it would show him how to remedy any of those defects. A proper analysis of the soil would not only direct the farmer the proper crops to grow on certain land, but the right manures to use for particular crops. It could not be doubted then that the information which the analysis of soils gave to the practical farmer was of the first importance to the successful carrying on of his operations.

Soil analysis naturally fell under two heads, namely, chemical and mechanical. The former showed the amounts of plant-food in the soil, and the latter whether the soil was in a condition to make use of them. It was a fact that land might be rich in plant-food, yet its condition might be such that the plant could not make use of it. The constituent elements of the animal or human body were the same as those of plants. If they analysed a plant or an animal they would find that

the chemical elements were the same, consequently the elements required to build up their bodies were the same. He showed by a tabulated statement on a blackboard the chemical elements of animal and vegetable life, and showed that they were identical. The essential difference between animals and plants was that the latter could make use of simple compounds and convert them into the complex substances of which they (plants) were composed, whereas animals could only utilise as food substances which had been previously elaborated in the plant or other animals. Thus animals took in phosphates, lime, potash, salts, &c., in the form of complex organic compounds (part of the tissues of plants or animals), whereas plants obtained them as simple salts dissolved in the water contained in the soil in which they grow. Another important difference between a plant and an animal was that the former was stationary, and had to obtain its food where it was placed, as it could not move about in search of it. He showed by a tabulated sketch on a blackboard that plants received their sustenance partly from the air and partly from the soil. The carbon, oxygen, hydrogen, and nitrogen were obtained from the air, whereas the phosphates, potash, and lime, and in some plants the nitrogen, were obtained from the soil. A chemical analysis of soil would actually determine the quantities of each of the elements contained in it, and a mechanical analysis would show its texture or its capacity for retaining water or moisture. With such knowledge the farmer could then unerringly determine the best crops to plant or the methods to adopt to improve his land to make it suitable for whatever crop he desired to plant. An important matter to consider in judging of the suitability of land for certain crops was its capillary power—that is, its capacity for retaining water. A rough sketch was shown of the appearance of a section of soil highly magnified. They would see that it was composed of minute particles with interstices between. The openness or closeness of these passages between the particles determined the power possessed by the soil of retaining and conveying to the roots of plants the necessary water. This capillary power had another peculiar characteristic. It was not only the means of drawing the moisture from the surface, but acted in the same way as the wick of a lamp, by attracting and conveying the moisture to the roots of the plant. The texture of the soil was a very important factor to take into consideration, as the more perfect it was the better able was the plant to make use of the plant-food it contained. In fact, if the condition of the soil in this respect was not satisfactory the plant could not absorb the moisture and food elements necessary to its growth. The elements obtained from the soil by the plant were lime, potash, phosphoric acid, and some other mineral compounds, all of them necessary for the sustenance of the life of the plant. Some soils contained them all in sufficient quantity, and were in a position to make use of them, and then did not require to be assisted by manuring. A careful analysis would show the farmer in which elements the soil was deficient and the elements which were present in abundance. He could then, by

adding the ingredients which were deficient for the crops he intended to plant, obtain the highest degree of productiveness from his land. Although all plants required the same elements, yet they did not all require them in the same proportion; and thus a soil suitable for one kind of crop might not be adapted to another. For instance, grasses, wheat, and all kinds of cereals required a soil in which nitrogen was in superabundance, while vines, fruit, beets, potatoes, and all plants which contained sugar and starch, required a soil rich in potash. Lucerne and clover required a soil rich in lime and potash, while turnips required principally phosphates. This was the reason why land cropped year after year with the same crop became impoverished, and ultimately unable to produce a healthy or abundant crop. The elements of food which the particular plant assimilated from the soil were being gradually reduced, and thus it became at last unable to sustain plants which required those elements in abundance. Lucerne required little nitrogen in the soil, as it was able to make use of the nitrogen from the air by means of its root-tubercles. From what he had said they would understand pretty well what foods the different plants required, and in what conditions they should be presented. In their attempts at improving the fertility of their land they would have to carefully consider the requirements of the crop they intended to plant, and introduce, by means of scientific manuring, the ingredients that that particular crop required in abundance, and which they had ascertained by analysis were deficient in the soil. And here he desired to say a word about manures. The difference between artificial fertilisers and farmyard manures lay chiefly in the greater solubility of the former as compared with the latter, and their greater concentration and consequent cheapness. He explained that plants could not make use of all the plant-food which was present in the soil, as they picked up the elements they required from the moisture in the soil by their roots. Many forms of plant-food in the soil were unavailable to the plant, and could not be utilised until they were broken down by the action of water and air. Hence the solubility of artificial manures was a great advantage, as they percolated to the roots of the plant, and were taken up and assimilated without undergoing any disintegrating process. The mechanical condition of the soil was as important to fertility as its chemical composition. However rich in plant-food, some soils were infertile because they were too stiff, too sandy, were deficient in humus, or were what is known as "sour." He explained that the soil was composed of minute particles, and the continuous distribution of water through it was due to its capillarity. Not only should water move through the soil freely, but air as well, in order to form a good tilth. In a good condition the tilth should contain about half the water it was capable of holding. The capacity of a soil for holding water depended largely on the humus which gave it power to withstand drought. For the purpose of increasing the humus in the soil green manuring was much better than stable manure. Green manuring, he explained, was simply ploughing in a green crop. When the capillary power was high there was a continuous movement of air and moisture. In this way the elements of

food were brought to the roots of the plant and absorbed. It would thus be seen that the first condition of fertility was that the soil should be able to convey the food elements freely to the plant, so that it could make use of them. If the soil was what is known as "sour," they should open it up, drain it well, and use lime freely. In the case of a deficiency of humus the remedy was to use plenty of farmyard manure or green manure. Then again, if they found the soil too stiff, they should open it up, drain well and use lime, and if it was too light, the remedy was to apply lime and green manure. In the case of low capillarity they should take means to increase the humus, and cultivate with that object. If it were ascertained that certain necessary elements were deficient for the crop planted, they should introduce the necessary fertilising ingredients when manuring. They should pay particular attention to cultivate the soil, so as to bring it into condition for making the best use of the manures introduced. He had made analyses of between twenty and thirty samples of soil taken from land in the neighbourhood of West Maitland, and found that it was fairly rich in all the elements necessary for the sustenance of plant-life. All the samples were fairly supplied with lime. He had taken an average of the various elements of plant-food contained in the samples he had analysed, and the result was as follows:—Lime (CaO) ·182 (satisfactory), 3,640 lb. to the acre, 6 inches deep; potash (K_2O) ·098 (satisfactory), 1,960 lb.; phosphates (P_2O_5) ·077 (fair), 1,540 lb.; nitrogen (N) ·107 (satisfactory), 2,140 lb. It would be seen that this was a most satisfactory result when he explained that an acre of wheat removed from the soil only 20 lb. of nitrogen, 60 lb. of phosphoric acid, and 20 lb. of potash. For the same extent a lucerne crop removed 70 lb. of phosphoric acid, 100 lb. of potash, 100 lb. of nitrogen, and 90 lb. of lime. In conclusion, he advised them of the proper methods to adopt in order to get an analysis of their soils. All that they had to do to obtain a full analysis of any samples of soil sent in to the Department was to forward an application form, properly filled up, giving a description of the land from which it had been taken. He advised them when sending in samples to take portions of it from different parts of their farms, and so get a fair average sample. In taking samples of soil he advised them to dig a hole where the soil was of average quality. Take a clean slice from it to the depth of 12 inches, and send from 6 to 8 lb., including stones, fibres, and everything. About 2 lb. of the subsoil should also be sent. Should the soil in different parts of the field be manifestly of different qualities, samples of each should be forwarded, properly marked for identification. They would not only receive a free analysis of the soil, but treatment of the land would be suggested, based on the analysis regarded in the light of the detailed history submitted.

Copies of the "form" referred to were distributed among the audience, also of a pamphlet by Messrs. Guthrie and Gurney, of the Department of Agriculture, on "Analysis of Commercial Fertilisers obtainable in New South Wales."

Several questions were asked the lecturer at the conclusion of his paper and answered satisfactorily. The paper was listened to with

rapt attention throughout, and considerable interest was exhibited by those present in the various topics dealt with.

Mr. George Bishop, in moving a vote of thanks to Mr. Guthrie, said he considered that he and everyone in the room had gained a considerable amount of knowledge that night. He contended that there was not a better agricultural district in New South Wales than the Hunter Valley, but that was no reason why they should show such apathy in taking advantage of such instruction as they had received that night. He predicted that it would be ruinous to continue cropping land year after year without putting anything back into the soil to replace that which they had taken from it. He was astonished that the farmers of the district did not take more interest in lectures on subjects such as this.

Mr. J. W. Boag congratulated Mr. Guthrie on the success with which he had succeeded in making so scientific and technical a subject so interesting.

How to Catch Caterpillars.

"The farmers in the Catskill district (New York State) are (says the New York correspondent of the London *Daily Chronicle*) rejoicing over the discovery of a means for combating a pest of caterpillars by which their orchards are being destroyed. The cure is as simple as it is novel, but it is declared to be entirely effective. The discovery, like many others which have astonished the world, was the result of an accident.

"A woman belonging to the town of Catskill happened to blow a horn underneath a tree, when she was surprised to see hundreds of caterpillars fall from the boughs. She blew another blast, and there was another shower of the little creatures. She hastened to tell others how she had found out the way to fetch the pest off the trees, and whole sections of the people turned out with drums, bugles, whistle-pipes, and every other noise-producing instrument in the town. The caterpillars, unable, it is declared, to resist the influence of the noise, continued to fall in showers to the ground, and were rapidly swept together for destruction.

"The organ-grinder has at length been proved a blessing in disguise, and performers of his class have been numerously employed night and day to grind their machines under the trees in the Catskill orchards and lure the caterpillars to their doom. Town bands have also been impressed to play "Yankee Doodle" and other national airs to the grubs."

The above clipping, from the *S.M. Herald*, probably refers to some plant or tree-eating caterpillars, like the "Gypsy moth," of America. It is quite true, reports Mr. Froggatt, that a sudden jar, stroke, or anything that would startle these caterpillars, would cause them to fall to the ground. With the cutworms which feed upon the ground, and never climb upon the trees, even the discharge of artillery would be of no avail.

The Popular Orpington.

(Concluded.)

GEO. BRADSHAW.

Orpingtons for Eggs.

FINE looks for the fancier, eggs and meat for the commercial breeder, and for the latter this chapter is intended.

When contemplating poultry-breeding the first question put by the novice relative to some recommended breed is, "Are they good layers?" eggs being the first consideration, and this question when put in connection with the Orpington has already been answered by the several contributors. Early layers, plentiful layers, and good winter layers, is the unanimous testimony of the several gentlemen whose extensive experience is a guarantee that the breed possesses the excellent quality of being prolific egg-producers.

One breeder places them next to Leghorns in that respect; but if his experience had been with present-day Leghorns, I am satisfied his testimony would be in favour of the black fowls.

Relative to this deterioration which goes on in all the breeds—some say Orpingtons excepted—but few Leghorn breeders would care to acknowledge any decline as egg-producers; however, that is from the fact that but few of the breed's present patrons have a knowledge beyond six or eight years of this variety, the earlier Leghorns being undoubtedly the very best of layers; it is also true that fanciers pay little attention to the egg output of their fowls. The proceeds of a few dozen eggs sold at fancy prices for setting purposes is of much more consequence than a two hundred yearly average per hen when current market rates only are obtainable.

Throughout these articles I have made what may by some be considered very unorthodox statements; but in every case I support these statements by quotations from reputable authors and fanciers, and in connection with this decline in the egg-production of various breeds there is possibly no greater acknowledged authority than Lewis Wright, author of the standard poultry work of our day. This veteran fancier writes in *The Feathered World*, of May last, "The Minorca egg yield is going down amongst the purely exhibiting fanciers who breed for large combs. The same process has gone on in the Leghorns, and the egg yield from them with us is less than with the Americans, who breed the original stamp of more moderate comb.

"Between one craze and another in succession the man who wants useful fowls, and yet also wants a nice uniform flock of truly bred fowls, is getting to have a hard time of it."

Reverting to the Orpingtons as egg-producers, they were put on the market as extraordinary good layers, and in all the available poultry

THE ORPINGTON DUCK.

literature, and the experience of over a hundred breeders, I cannot find a single complaint about any deterioration so far. Their next trait is relative to their winter laying, and in this respect they certainly beat Leghorns, this winter laying being their most profitable feature; everybody's hens of whatever age or breed lay in the spring-time, when eggs are from 5d. to 7d. a dozen, and were this the price throughout the year there cannot be a doubt but the expression "Poultry don't pay" would be more than a vague phrase. April, May, and June are the months when eggs reach to 1s. 8d., 1s. 10d., and 2s. a dozen, consequently it will seen if Orpingtons produce them in those months the inference is that they are the most profitable variety we have. The following table, kindly supplied by the *Daily Telegraph*, giving the average monthly market price of eggs per dozen during the past two years, will make apparent the profitable character of winter layers over breeds failing in this characteristic:—

	1897.	1898.	1899.
	s. d.	s. d.	s. d.
January	1 0	1 1	1 0
February	1 3	1 3	1 2
March	1 3	1 3	1 4
April	1 6	1 6	1 7
May	1 9	1 7	1 11
June	1 7	1 6	1 9
July	1 3	1 3	...
August	0 10	0 10	...
September	0 7½	0 7	...
October	0 6½	0 7½	...
November	0 8	0 7	...
December	1 1	1 0	...

In conclusion, Orpingtons have been shown to be early layers, plentiful layers, and winter layers, qualities which should commend them to those whose object is, as Mr. Graham aptly puts it, "the pocket."

Orpingtons for the Local and Export Markets.

The object of all commercial poultry-keeping is the profit resulting from the sale or consumption of the eggs and meat which the fowls produce, the extent of this profit depending on the quality of the goods and the state of the markets wherein this produce is disposed.

The whole egg supply of the Colony is very little more than the consumption, hence a fair profit may be had on the average price throughout the year, which can be much increased by the cold storage facilities offered to producers by the Agricultural Department, the past season's operations demonstrating the large profits resulting from this now perfected system of egg preservation; however, as this subject of cold storage, as applied to eggs, is to be fully dealt with by Mr. Stephenson,* I will proceed to the meat part of the question, and commence by saying that the average price of the average fowls which reach the city markets throughout the year must show but an infinitesimal margin over the cost of production, nor does the cold storage for the local market much affect this, the 100 or 200 per cent. possible in the egg business being reduced to 20 or 30 per cent. where fowls are concerned,

* Page 900, this issue.

this small difference between the highest and the lowest poultry prices throughout the year precluding the cold storage system from being profitably applied to that product locally. Realising this, the Board for Exports some two years ago, by trial shipments and other means, demonstrated that markets were awaiting us abroad. Cold storage again coming to the rescue, the operations of the Board during this time awakened a poultry interest amongst the farmers of the Colony, who were hitherto apathetic on the subject, and if but a moiety of the advice given to inquirers be put into practice, the extraordinary developments of the past eighteen months should be increased four-fold. Added to this, the Press has given due prominence to these developments and the possibilities of this hitherto much neglected industry, whilst the majority of the Agricultural Societies have expressed, and many of them show a desire to carry out the Department's wishes, by making poultry, like the other sections of their shows, an educational one, and to that end are offering prizes for birds fit for export, and issuing regulations by which they should be exhibited and judged.

In connection with this branch of the Orpington subject, which gives the title to this chapter, the past twelve months have afforded a valuable object lesson as to the future of the export trade. During that short space of time many questions of much interest to the industry have been set at rest—first, that in spite of the dismal forebodings it has been effectively demonstrated that our poultry can be put on the English market as fresh, as tender, and sweet as the day it left the poulterer's hands here; second, that poultry of whatever breed, if young and meaty, can, during certain months of the year, be put on the London markets at handsome profits over that obtainable locally, and, third, although the oversea markets may, like our own, fluctuate, still with first quality goods, no matter to what extent the increase be, the home markets cannot, at least from us, be overstocked. One firm alone, Messrs. C. E. Brooke and Sons, of Leadenhall Market, writing that the same quality chickens as those sent in April last can be disposed of to the extent of 10,000 per week, a quantity which for some years we may not even hope to be able to forward; but realising that breeders are anxious to make an effort to largely increase last year's output, the following observations and advice to that end are given.

From whatever cause arising, a very prevalent opinion exists that *only* white-legged fowls are suitable for the London requirements—an opinion which, from the inception of the export trade to the present time, has had to be almost daily controverted. Were these white-legged fowls available, there would be some reason in their advocates' unreasonablenesss; but the fact remains that of the 50,000 head handled at the works, not twenty of these mythical chickens have yet been offered from one shipper, and if the poultry export trade was kept waiting till the effect of this colour delusion had supplanted our present breeders' stocks with those of a more uniform one, I fear the wait would be long.

As replies to this colour and breed question involve an almost daily correspondence, to curtail such I supply the following communication, received a few days ago, and which embodies the bulk of those to hand

on the same subject:—"Would you kindly give me a little information regarding poultry-breeding? What I want to know is, which breeds you prefer for table purposes or for export? I have Colonial Game, Orpingtons, Langshans, and Wyandottes; but as I hear so many different opinions expressed as to the superiority of one over the other, I would be very pleased if you would give me your opinion regarding these breeds, and any other information connected with poultry-breeding for export. Yours, &c., ..."

My correspondent is a most practical, successful South Coast farmer, and a breeder and judge of farm stock, and a well-known poultry exhibitor of various breeds. However, the very fact of his inquiries is conclusive evidence that his operations were conducted more for exhibition than commercial purposes; otherwise the results of the simple experiments I recommended would have long since been as apparent to him as those of other live stock of the farm. My reply was as follows:—"Dear sir,—Your query *re* best breeds for export is similar to many which reached the Agricultural Department on the same subject. Poultry for the English markets will pay well to arrive in February, March, April, and May, the prices falling in June, but still paying ones, the July prices less expenses, rarely showing much margin over those obtained locally. For the English, or any market for that matter, it is not a question of breeds, but quality—plump meaty chickens of from 3 lb. in the early months up to 5 lb. later in the season. Almost any of the popular breeds, crosses, or even mongrels, will do. Meat is wanted, not breeds. The varieties you have are all excellently suited, except the Langshans, which take longer to develop, consequently less profitable. With your long experience of many breeds, you will know which variety can be brought to the above weights in the shortest time; herein lies the whole secret of profit. If the chickens are not plump and meaty, the fact of them having white legs will not secure them a readier market. If a crate each of fleshy white-legged chickens, and one of yellow in equal condition, were put on the London market, possibly the former would fetch a few pence per pair more; but then your climatic or other conditions may be such that the yellow or black-legged fowls would be hardier, grow quicker, and consequently be more profitable than the now much-neglected whites. If I was in your position I would put two hens each of your various breeds with the Colonial Game, and as the progeny would all be reared under the same conditions, you would be a daily witness of the growth, qualities, and possibilities of the various crosses; and if you could take time to weigh a few of the chickens at the end of each month, the result would place beyond the region of doubt which crosses really would be the most profitable, at least for you; but poultry experiences are so variable that possibly your nearest neighbour, conducting the same experiments, might have a different result. If plentifully fed and healthily kept, any of your crosses will most excellently suit the English purchasers; and when that market becomes unpayable, Sydney can absorb large quantities of good quality birds at prices which will go far to prove that with you poultry breeding will pay."

The first trial shipment of poultry to England in 1898 were Colonial Game chickens. They arrived very late in the season, realised 6s. per couple, and were most favourably reported on. The first of the shipments the present year were Game-Orpingtons; they also realised 6s. per couple, the London merchant reporting upon them as follows:—"Special praise must be given to the chickens. We could easily dispose of 500 cases weekly between February and June. The chickens from New South Wales are far superior to Canadian, Russian, Austrian, or any other chickens that are coming from abroad." Later shipments which arrived in April, May, and June also brought the same price. Several cases of these, as far as breeding is concerned, were nondescripts—the veriest mongrels—but of course were young, and carried a good amount of flesh; and this is what the London salesmen want—meat, not feathers. The fact of mongrels bringing the same price as first-crosses or pure-breds is no reason for any inference that they are as profitable, for they are of much slower growth, less vigorous, and more subject to disease. Uniformity in appearance, other things being equal, is also a consideration. Concerning the question of breeds and breeding, I have also the valuable testimony of one of the largest Liverpool (Eng.) poultry and game merchants, Alderman J. Ruddin, who lately visited this Colony, and was for some time a daily visitor at the Government Cold Stores, being much interested in the operations there. In conversation with Mr. Ruddin I ventured the question,—Which of the breeds best suited his trade? With a look of astonishment he replied, "Why, Mr. Bradshaw, I have been in the business for over forty years; I turn over many thousands of pounds annually, and I don't know one breed from another. I want good fowls, not breeds. Talk to fanciers about breeds and fine feathers; but to poultry merchants about fine flesh. Send us plenty of good young chickens and ducklings in the spring, and we will not trouble you about breeds."

From the above it will be seen that the Liverpool merchant confirms in every particular the information supplied by Messrs. Brooke, good, young, meaty carcases being the requirements. However, with all the above testimony, showing that meat is wanted, the question of breeds again presents itself. The profits of the breeder depends on the time, labour, and expense incurred in bringing the chickens from the shell to the market; and the breed or cross which can be brought to this state in the shortest time, all other things considered, is the most profitable breed.

White-legged, white-flesh fowls of otherwise equal merit will, as told before, realise the most; but to get this class and quality, we have to fall back on the scarce and difficult-to-rear Dorking, their scarcity being such that I believe fifty strong male birds for stock purposes could not be obtained in the Colony. Then we have the recently-introduced Buff Orpington, which, for colour of skin and flesh, equals the Dorking, and are spoken of by all their patrons, as the ideal table-fowl. However, up to the present a single specimen has not yet been presented at the works, and of the few I have seen denuded of feathers they were far from the desired plumpness. Still, as Buffs will

become more plentiful, some specimens will, in the usual order of things, reach our markets, when it will be quite time enough to testify to their merits as profitable to rear for the English or local markets. Again, reverting to this colour question, Mr. Edward Brown, F.L.S., in his practical guide to poultry fattening, says:—"It is desirable to mention that in Britain there *has* been a strong prejudice in favour of white-legged fowls for table purposes, it being thought that black-legged fowls were not nearly so fine in flesh. Happily the prejudice is dying out, for it has been abundantly proved that two or three French breeds are quite equal to the Dorking in table properties, and there is not one of them with white legs and feet. The colour of the pedal limbs is not influenced by, nor does it influence that of, the skin and flesh of the body. In making a selection for breeding table poultry, we strongly urge raisers, as far as possible, to avoid heavy-legged and heavy-boned fowls. The legs of fowls are composed of sinews and veins, which are tougher and of less food value than the breast meat. The latter we wish to develop. A further point is, that all feathered-legged birds should be avoided for table purposes. These ornamental additions to the legs and feet have to be maintained, and this can only be done at the expense of economic qualities. It has been proved again and again that since leg feathers have been so much developed on the Cochin and Brahma, both these breeds have deteriorated in respect to egg and flesh production, and the reason of this change must be obvious to all who have studied the laws of breeding. A further question is to the relative weight of meat and bone upon fowls, because, in selecting table poultry, it is not so much the size of frame we must look to as the actual amount of food thereon."

In confirmation of the opinions above expressed relative to breeds, the following extract from the Sydney *Daily Telegraph* of the 12th August will be found of interest:—

Sydney Chickens in London.

Mr. J. J. Horrocks, of Equitable Buildings, the local representative of Messrs. C. E. Brooke and Son, Leadenhall Market, London, has furnished us with the following extract from a letter dated London, July 7th, received from his principals by this week's London mail:—"The chickens *ex* 'Australasian' made 4s. each, and were very fine. Only get them here earlier, and any quantity can be sold at from 4s. to 5s. each with no difficulty. They are the finest frozen chickens that came to our market, and the way they have been killed, dressed, and prepared, is deserving of every praise. Although there have been large quantities of Canadian, Russian, Hungarian, and other varieties, there is no comparison between them and the chickens that come to us from Australia. I hope you will be able to get us large supplies for the forthcoming season." This is good news, indeed. The chickens referred to were shipped by Messrs. Boyd, of Gosford; Gray, of Paterson; and Hoffman, of Parramatta. They comprised a lot of good-sized birds, carrying plenty of meat, but were a mixed lot, and not by a good deal the best that could be sent from here. The "Australasian" took the last shipment from Sydney. She left on May 5, and the birds were sold during the first week in July, which is quite the tail end of the London season for frozen poultry. Considering that these birds, which could not be classed as the primest, realised so late in the season a price that will clear the breeders here over 6s. per pair, all doubts about there being a profitable outlet in London for colonial poultry should be dispelled, more especially in view of the fact that the agents, as stated above, are confident of realising prices equivalent to over 8s. per pair to the breeder, if the birds are only placed on the market earlier.

This, then, brings us back to the Black Orpington as a fowl having all the attributes constituting a most profitable variety to breed for market purposes. They have short legs, free from feathers; fine in bone; wide and deep in body; full breast; the frame excellently suited whereon to quickly build meat; and for those who intend going in for breeding poultry for market purposes I can safely recommend this breed as one of the first they should try. In breeding them pure, and properly treated, they make most excellent carcases, and can be as cheaply brought to a marketable stage as any known variety, while, for crossing purposes, Mr. W. Cook's testimony will be conclusive, wherein he says:—"Cross-breeding in the past has not been looked upon favourably by old-school breeders, whose conservative notions have always hindered progress like this; but in many instances advanced spirits of their generation have indulged in this to a certain extent, and so many crosses have been tried with good results. If I may be permitted to give a piece of personal experience, I may say I have learned more of the real value of breeds through crossing than by any other means, and it was while crossing that I gained that insight into the characteristics of the various breeds which enabled me to choose out the best varieties with which to build up the various Orpingtons, which are now so popular. The crosses of the future, however, bid fair to transcend every other. Poultry keeping is an industry which is progressive, and the future will be the best in very many ways. While the best of the old breeds will always remain, and as far as they are useful do very much to strengthen and build up the new ones, the new breeds will form material out of which many good crosses might be formed.

"It must never be thought that crosses are antagonistic to pure-bred fowls. This is not so to any appreciable extent, though some prefer such birds on account of their hardiness and extreme strength of constitution, which makes it easier for the inexperienced poultry-keeper to keep them with good results than even pure-bred birds that need more attention and more skilful management. Crossbred birds will often lay when birds of pure breeds will have ceased altogether. This is a great consideration, for where this is the result the eggs so laid will constitute an additional gain. A great many poultry-keepers who have a good stock of the old kind, are anxious to avoid the outlay occasioned by a complete clearance; so in many instances farmers have adopted a plan I advocated some years since of turning down an Orpington cockerel with hens of a barn-door type, with the object of improving the birds. The result has been a large increase in the number of eggs laid, and a marked improvement all round, shapely good birds being produced free from disease and the weakness consequent on rapid deterioration; so where good mongrels have been kept and done well the Orpington cockerels have worked wonders, confirming every good point and introducing others by this fresh blood."

Orpingtons can be bred pure profitably for the markets, while for those who prefer cross-breeding there are several breeds which can be judiciously used. A Dorking cock, if mated with eight or ten Orpington hens, will make a breeding pen of the very first order; the chickens

hatch very strong from this cross. They grow quickly, feather fast, and are in killing condition at almost any age from four months, and the majority of the chickens will take after the male in leg colour. A short legged Colonial Game cock mated with the same number of hens can also be recommended. The chickens from these will be more plump than the Dorking cross, the majority of them coming black. Plymouth Rocks have been tried with Orpingtons, but the results have never been satisfactory, inasmuch as they are slow in feathering, and although making very large birds, require a much longer period in attaining this, involving a much larger outlay. I have just to add that my opinions on Orpington-crossing have undergone no change from the time I wrote on this subject two years ago, an extract from that article concluding this chapter.

"The breed suits any climate or condition. They do well in either confined yards or free range; the chickens are hardy, feather and grow quickly, and when well fed should, at four months old, weigh from 4 to 4¾ lb.; hence, for either local market or export purposes, they are most admirably adapted. With a variety for which so many excellencies are claimed there should be no need to recommend crossing, as the advantages are not too apparent. They have, however, been largely resorted to to improve farmers' poultry. The best system is to kill off all the common cocks and cockerels, as well as all small or deformed hens and those over 2½ years old, and then introduce a big-bodied short-legged cockerel to about every dozen hens; and when this is repeated two or three years in succession, and each year fresh cockerels used, the common poultry will generally have become a uniform black colour, while the laying and table properties will have undergone a change from unremunerative to profitable poultry culture."

Mr. L. L. Ramsay, hon. secretary of the N.S.W. Poultry Club, has devoted great attention to these truly popular fowls, and for some years has been the chief importer of the breed from England. On three occasions his birds came from the celebrated yards of Mr. J. Partington, whose successes in the Old Country have been phenomenal. As a result of his enterprise and trouble in securing excellent stock, Mr. Ramsay has carried off the championship for the best Orpington at the Poultry Club Show, in 1897 and 1898, and again in 1899. From the fact that a bird bred by Mr. Ramsay beat the Birmingham prize-winner, and that his Colonial-bred stock are the progenitors of very many of the principal prize-takers, it is clear that in this Colony the Orpington will thrive to perfection.

It may also be mentioned that the first importation of buffs came direct from Mr. Cook's yards to Mr. Ramsay. As a breeder of numerous varieties of fowls, Mr. Ramsay maintains that Orpingtons are still the best, and fortifies his opinion with the fact that he has a ready sale for all eggs produced by his large stock of this breed, and for all the young stock he can spare. For further evidence as to their popularity Mr. Ramsay points to the increasing entries at the Club's Shows, as tabulated below:—

1897...	121 Orpingtons.
1898...	123 ,,
1899...	132 ,,

The following particulars of prize-winners at the Poultry Club Shows for the years 1897, 1898, and 1899, should be read in conjunction with the statement which appeared in last issue.

POULTRY CLUB SHOW.

1897.—Orpingtons, 121.

Black—			
Cock	1 L. L. Ramsay.	2 H. M. Hamilton.	3 Bonaventure P. F.
Hen	1 Mrs. Clay.	2 H. M. Hamilton.	3 F. C. King.
Cockerel	1 J. E. Pemell.	2 J. E. Pemell.	3 W. H. McKeown.
Pullet	1 J. E. Pemell.	2 W. H. McKeown.	3 D. Sutherland.
Rosecomb—			
Cock or cockerel..	1 M. Graham.	2 L. L. Ramsay.	....
Hen or pullet ...	1 L. L. Ramsay.	2 Bonaventure P. F.	3 L. L. Ramsay.
Buffs—			
Cock or cockerel..	1 R. Graham.	2 L. L. Ramsay.	3 L. L. Ramsay.
Hen or pullet ...	1 L. L. Ramsay.	2 L. L. Ramsay.	3 P. Fletcher.

1898.—Orpingtons, 123.

Black—			
Cock	1 L. L. Ramsay.	2 W. Harris.	3 H. Howarth.
Hen	1 J. E. Pemell.	2 J. W. Clay.	3 H. M. Hamilton.
Cockerel	1 Bonaventure P. F.	2 R. Graham.	3 J. E. Pemell.
Pullet	1 J. E. Pemell.	2 L. L. Ramsay.	3 J. E. Pemell.
Buff—			
Cock	1 R. Graham.	2 J. E. Pemell.	3 L. L. Ramsay.
Hen	1 L. L. Ramsay.	2 R. Graham.	3 H. M. Hamilton.
Cockerel	1 R. Graham.	2 R. Graham.	3 J. E. Pemell.
Pullet	1 H. Grant & Co.	2 J. E. Pemell.	3 R. Graham.

1899.—Orpingtons, 132.

Black—			
Cock	1 L. L. Ramsay.	2 L. L. Ramsay.	3 Clydesdale P. F.
Hen	1 L. L. Ramsay.	2 L. L. Ramsay and J. E. Pemell, equal.	
Cockerel	1 W. M. Fairland.	2 W. H. McKeown.	3 J. E. Pemell.
Pullet	1 J. E. Pemell.	2 L. L. Ramsay.	....
Buff—			
Cock	1 L. L. Ramsay.	2 L. L. Ramsay.	3 J. E. Pemell.
Hen	1 L. L. Ramsay.	2 H. M. Hamilton.	3 J. E. Pemell.
Cockerel	1 J. E. Pemell.	2 R. Graham.	3 Mrs. Ewing.
Pullet	1 L. L. Ramsay.	2 J. E. Pemell.	3 Mrs. Ewing.
Novice—			
Cock or cockerel..	1 H. Davies.	2 R. F. Cook.	3 A. Stuart.
Hen or pullet ...	1 T. Whitehead.	2 W. Adnam.	3 Dr. Fiaschi.

Judging Orpingtons.

Immediately after the publication of the Wyandotte pamphlet—now out of print—many communications were received complimenting the Department's artist on so faithfully portraying that breed, and thus making the standard, as supplied by the Wyandotte Club, intelligible; and anticipating a similar desire by the patrons of the Orpington for the standard by which they are judged, such is supplied below, while the various illustrations will assist in the interpretations of these standards.

The standard for the Black Orpington, as published by the Orpington Club, is as follows :—

Cock.

Plumage.—Black throughout, with a green sheen upon it, free from coloured feathers.
Head.—Small, neat, fairly full over the eye, carried erect.
Comb.—Medium size, erect, evenly serrated, free from side sprigs.
Face, Earlobes, and Wattles.—Red.
Eye.—Black, or dark, with dark brown iris.
Beak.—Black, strong, and nicely curved.
Shape.—Cobby and compact.
Breast.—Broad, deep, and full, carried well forward, long breast bone.
Back.—Short, with broad shoulders.
Saddle.—Rising slightly.
Tail.—Medium size, flowing, and inclined backward.
Hackles.—Full, both neck and saddle.
Legs and Feet.—Black, strong, short, four claws on each foot, with white nails, sole of foot white.
Skin.—White, thin, and fine in texture.
Carriage.—Erect and graceful.
Weight.—Between 8 and 11 lb. ; up to 13 lb. when fully matured.

Hen.

Plumage, Head, Comb, Face, Beak, Eye, Breast, Legs, and Feet, Skin, Flesh, and Carriage.—Same as in cock.
Tail.—Medium size, inclined backward and upward.
Cushion.—Sufficient to give the back a short and graceful curved appearance.
Weight.—About 7 or 8 lb., and in rare instances up to 11 lb. when fully matured.

White and Buff Orpingtons, same as above excepting in colour. Below are the points for judging :—

Points for Judging.

	Black.	Buff.
Pluming and condition...	10	30
Head	5	5
Comb	7	5
Face	5	3
Beak	3	3
Eye	5	5
Shape	15	15
Breast	10	10
Tail	5	
Saddle or Cushion and Back	5	8
Legs and feet	5	5
Skin and Flesh	5	5
Carriage	10	3
Weight	10	3

Disqualifications.

Feathers or fluff on legs or feet.
Yellow skin.
Yellow in legs or feet.
Long legs.

[This series of articles is being bound in pamphlet form, and copies will be available shortly.]

Crop Experiments at Gulgong.

Mr. J. C. Watson, of Narragundi, writes:—"About the beginning of the year I promised to send the results of some experiments, with other data connected with them, conducted on this estate. Although they are by no means original, still, they will serve to show what can be done in this part of the country."

WHEAT.—Different manures.

Variety.		When sown.	When reaped.	Result. Seed.	Manure used.	Remarks.
		1897.	1897.	lb.		
Purple straw.	1	8 July	12 Oct.	25; or 41⅔ bus. per acre.	Completely rotted farm-yard—30 tons per acre.	½ lb. of seed used in each case. In drills covering $\frac{1}{100}$ part of an acre = 50 lb. seed per acre—usual sowing about here. Frequently hoed between drills. No. 5 particularly free from smut; others affected. No water used. Light sandy loam soil.
	2	8 "	12 "	19½; or 32½ bus. per acre.	Superphosphate—2 cwt. per acre.	
	3	8 "	16 "	15; or 25 bus. per acre.	Unleached wood-ashes—6 cwt. per acre.	
	4	8 "	16 "	18; or 30 bus. per acre.	Fresh Fowl—6 cwt. per acre.	
	5	8 "	11 "	17; or 28⅓ bus. per acre.	None. Seed soaked in horse-urine for twenty-four hours before sown.	
	6	8 "	20 "	13½; or 22½ bus. per acre.	None	

The above experiment, No. 1, was carried out to see if the soaking of seed in urine had any permanent effect on the crop. The result surprised me, for I thought that the treatment would only cause it to germinate quickly. The other five samples were not treated with any solution whatever, and consequently developed "Smut" (Ustilago segetum) to a small extent. The urine-treated crop was free, excepting one head.

Further trials will be made, both with ammonia and urine, for I am not satisfied with only one test.

The next experiment, No. 2, was carried out to see if chemical manuring will pay here, considering the carriage from Sydney.

Experiment No. 2.

The manure selected for the trial was Superphosphate No. 2, at £5 2s. 6d. per ton delivered Sydney Railway Station or wharfs. The freight to Mudgee for 6-ton lots is 11s. 4d. per ton (I think it is cheaper now). The carriage per team from Mudgee to Gulgong is 12s. 6d. per ton. Thus, delivered here, the price is £6 6s. 4d. per ton, and that price is the one on which I worked.

Soil.—A sandy loam, very poor, made so by continual cropping without manure.

Cultivation.—Ploughed 10 inches deep, and brought to an exceedingly fine tilth in the ordinary way. Entirely free from couch or any other weed. Shallow drills were drawn out 3 feet apart, covering 1 acre, and the manure sown in alternate drills. Thus—1st row, manure; 2nd row, no manure; 3rd row, manure, and so on. (Information from page 676, vol. 7, part 10 of the *Agricultural Gazette.*)

There were twenty-eight drills, and I decided to sow 8 lb. manure to each; this equals 1 cwt. for the fourteen manured drills, or 2 cwt. per acre.

The soil was stirred frequently between the rows to keep down any weed, and no row was favoured any more than another as far as the cultivation goes. Results:—

	s.	d.
14 Manured Rows—		
Cost of seed	2	4
Do manure	6	4
Total for ½ acre	8	8

	s.	d.
14 Unmanured Rows—		
Cost of seed	2	4

Or 4s. 8d. for 1 acre.

Result—Hay.

	t.	c.	q.	lb.
14 manured rows yielded	1	4	0	0
14 unmanured do	0	18	0	14
Difference in favour of manure	0	5	3	14

Thus, doubling these figures—

t.	c.	q.	
2	8	0	is produce of 1 manured acre.
1	16	1	do unmanured do.
0	11	3	is difference per acre.

Hay.

	£	s.	d.	Less seed and manure. s.	d.	Net. £	s.	d.
At £2 per ton the manured acre is worth	4	16	0	17	4	3	18	8
,, £3 do do do	7	4	0	17	4	6	6	8
,, £4 do do do	9	12	0	17	4	8	14	8
,, £5 do do do	12	0	0	17	4	11	2	8
				Less cost of seed.				
,, £2 per ton the unmanured acre is worth......	3	12	6	......		3	7	10
,, £3 do do do	5	8	9	......		5	4	1
,, £4 do do do	7	5	0	4	8	7	0	4
,, £5 do do do	9	1	3	......		8	16	7

A glance at this table shows that from £2 10s. per ton and upwards it pays to get commercial fertilisers from Sydney.

Experiments with Water-glass and Lime-water for Preserving Eggs.

MESSRS. F. T. SHUTT, Chemist, and A. G. GILBERT, Poultry Manager of the Central Experimental Farm, Dominion of Canada, have been good enough to furnish the following report on experiments conducted by them to test the merits of water-glass for preserving eggs:—

Having received numerous inquiries from farmers during the past two months respecting the merits of water-glass as a medium in which to keep eggs, we are led to think that certain conclusions drawn from an experiment, lately brought to a close, with this and other preservatives, will be of interest to readers of the *Agricultural Gazette* of New South Wales.

The investigation was commenced last September, perfectly fresh eggs from the farm poultry-house being used for the test, which consisted in immersing the eggs for varying lengths of time, from a few hours to six months, in (*a*) lime-water, and (*b*) 10 per cent. solution of "water-glass." Those eggs which were treated for a few hours, days, or weeks, as the case might be, were subsequently placed, together with the untreated eggs to be used as a check, in a rack within a drawer in the laboratory till the close of the experiment, March 30th, 1899. All the eggs were at a temperature from 65° to 72° F., throughout the trial.

The testing consisted in breaking the eggs into a glass, and noting the appearance of the "white" and yolk, whether the yolk was stuck to the shell, size of air-space, odour, &c. The eggs were then poached and again the odour, appearance, &c., noted. Without giving in detail the results of the various trials, it may suffice for present purposes to summarise the conclusions reached, as follows:—

Conclusions.

1. In no instance, either of treated or untreated eggs, were any "bad" eggs found.

2. In all cases where the eggs were not kept covered throughout the period of the test with the preservative solution, shrinkage of the contents had taken place, as shown by the larger air-space, the less globular form of the yolk, and in many instances by the adherence of the yolk to the shell. The eggs treated for seven days and less with lime-water showed somewhat less shrinkage than those treated a similar length of time with silicate of soda.

3. It would appear that lime-water and "water-glass" used continuously are equally efficacious in preventing shrinkage. They

may also be said to give practically the same results as regards both external and internal appearances, flavour, &c., of the eggs preserved. Since "water-glass" (silicate of soda) is more costly and more disagreeable to use than lime-water, we could not from the present results recommend the former as the better preservative.

4. The albumen or "white" in all the preserved eggs was very faintly yellow (though not to the same degree in all the eggs), the tint becoming deeper on boiling.

5. No offensive odour was to be perceived from any of the eggs when broken, but in all instances a faint but peculiar musty or stale odour and flavour developed on poaching.

6. It is probable that no preservative will prevent the loss of flavour possessed by the fresh egg, but those which wholly exclude the air (and thus at the same time prevent shrinkage from evaporation) will be the most successful. Continuous submergence is evidently better than treatment for a few days.

"Water-glass," known chemically as silicate of soda, is a fluid quoted at 60 cents per gallon. It is highly caustic, due to excess of soda, and consequently is more disagreeable to use than lime-water.

The lime-water may be made by putting 2 or 3 lb. of good fresh lime in 5 gallons of water, stirring well at intervals, for a few hours and then allowed to settle. The clear supernatant fluid can then be poured over the eggs, which have been previously placed in a crock or water-tight barrel. Some authorities recommend the addition of a pound or so of salt to the lime-water, but the writers are of the opinion that this is unnecessary, and probably leads to the imparting of a limey flavour to the eggs, by inducing an interchange of the fluids within and without the egg.

The all-essential points to be remembered are: (1) that the eggs to be preserved shall be perfectly fresh; and (2) that they shall be covered with the preservative fluid.

Export of Fruit Pulp.

Further shipments of fruit pulp to London will be made during the forthcoming season. Growers desirous of disposing of surplus fruit in this way should communicate with the Board for Exports for particulars as to cost of transit, markets, &c.

Hawkesbury Agricultural College and Experimental Farm, Richmond, N. S. W.

PROSPECTUS.

Officers and Staff.

Principal: GEORGE VALDER.
Science Master: E. CLARENCE WOOD, M.A., B.Sc., B.E.
English Master: C. T. MUSSON, F.L.S. (London).
Lecturer in Veterinary Science and Practice: S. C. POTTIE, M.R.C.V.S.
Registrar: S. F. ADAMS. *Farm Foreman:* GEORGE COBB.
Dairy Instructor: C. R. CASSIDY.
Agriculturist and Apiarist: J. J. MCCUE.
Orchardist: J. ALFORD. *Foreman Carpenter:* ADAM BROOKS.
Blacksmith: I. SHAW. *Housekeeper:* MRS. RICHARDSON.
Medical Officer: DR. JOHN GIBSON.

Lectures are also delivered periodically by Mr. Hawkesworth, Wool Expert, Mr. O'Callaghan, and other experts of the Department.

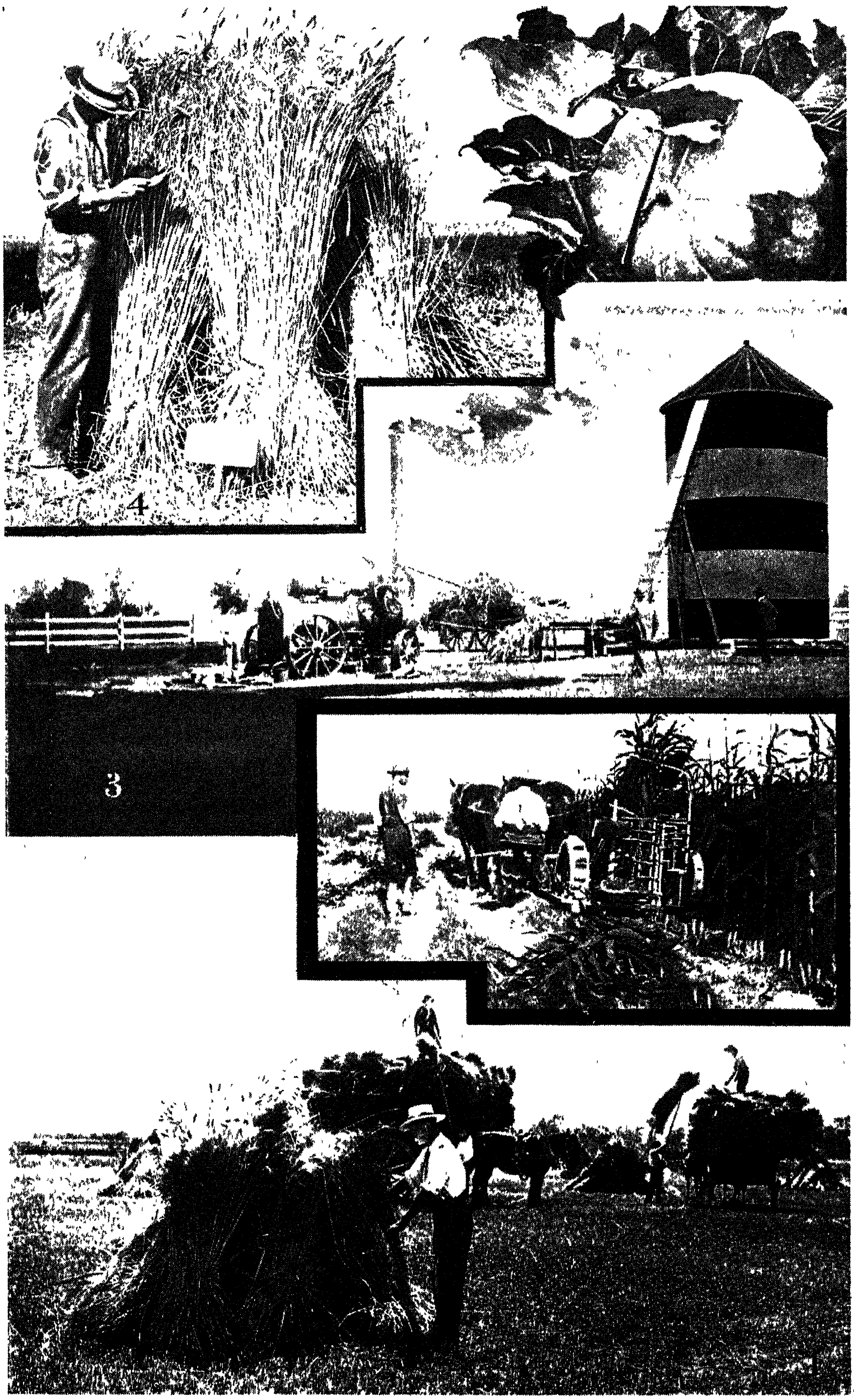
Objects of the Hawkesbury Agricultural College and Experimental Farm, and conditions under which Students will be admitted thereto.

Objects of the Institution.

THE primary object that the Department of Agriculture had in view in establishing the above-named College and farm was to teach the science of agriculture and the various other sciences connected therewith, and their practical application in the cultivation of the soil and the rearing and management of stock, and qualify its students, as far as possible, for the profitable management of farms, dairies, orchards, or vineyards, either as proprietors or paid managers of same.

To this end it is deemed indispensably necessary that every young man who may be admitted to the College shall learn to labour and become proficient in the use of the various implements of husbandry employed on the farm, and in the management of the various kinds of live stock connected therewith. Each student, therefore, will be required to perform a certain amount of labour, and those who decline to cheerfully engage in any practical work allotted to them by the Principal will not be allowed to remain at the College.

One other object held in view in establishing the farm is the conducting of experiments in various branches of agriculture, but more particularly in respect to the comparative value of the various artificial or commercial fertilisers, rotation of crops, and growth of plants suitable to our climate, but not generally adopted in our agriculture.



THE HAWKESBURY AGRICULTURAL COLLEGE FARM.
1, Harvesting Wheat; 2, Cutting Maize for the Silo; 3, Chaffing Maize and Filling Tub Silo; 4, A Stook of Medeah Wheat.

In a word, it is designed to carry on experiments in each department of agriculture for the purpose of improving its processes and enhancing the value of its products.

Students will have access to the experimental grounds and all other parts of the farm, which comprises an area of 3,500 acres, under such rules as may be submitted by the Principal from time to time, and approved by the Minister.

The Curriculum.

The course of study will comprise the principles of agriculture, chemistry, botany, vegetable pathology (including the use of the microscope), entomology, veterinary science and practice, mechanics, elements of surveying, farm book-keeping, besides all kinds of practical work on the farm, instructions in field operations, the use of farm implements and machinery, all dairy operations, necessary carpentry, and engineering required on a large farm, the management of stock, bees, and poultry, viticulture, wine-making, and all branches of gardening and orchard work as shown in the syllabus.

The course will extend over two years, or four sessions.

Any student entering the College except at the commencement of the January session shall engage in practical work only during that session, and at the commencement of the next academic year enter upon his College course for his diploma.

Conditions of Admission.

Age.—Each candidate for admission must be over the age of 16 and under that of 25 years.

Parents and guardians of students under 21 years of age will be required to give an undertaking that they will at all times conform to the rules and regulations for the management of the College and farm, and students over the age of 21 years shall give a similar undertaking.

Applications for admission of students will be received by the Principal at any time, but a student will be selected for appointment to a vacancy according to his qualifications, as follows:—

1. By producing his certificate of having passed the Senior or Junior University examination candidates passing either of these examinations will be admitted in the order of merit.
2. Failing one of the above certificates, applicants must supply a certificate showing a fair competency in Reading, Writing, and Arithmetic.

Physique and general aptitude for College work will be considered in conjunction with the candidate's educational attainments.

Each applicant must produce a satisfactory testimonial as to character from his last teacher or employer, and a medical certificate from a duly qualified and registered medical man as to his state of health.

Fees and Deposits.

A fee of £25 per annum, payable half-yearly in advance, will be charged for the maintenance and education of each resident student; and if after the expiry of one month from the date of the payment of this fee an enrolled student fail to put in an appearance at the College, he shall then be considered disqualified, and the fee paid shall be forfeited, unless he can satisfy the Minister that his absence was due to some sufficient cause.

A deposit of £3 must be paid in advance to cover laundry expenses, damages, &c. The laundry work is done by contract, and each student is

charged for the washing he has had done during the session. The damages to College property are charged to a general fund, and the total amount is divided equally among the students in attendance at the time, and a proportionate amount will be deducted from each student's deposit. An account is sent in at the end of each session for the laundry and other expenses incurred, and on this being paid the deposit is made good. When a student leaves the college it is necessary to pay his account, and the deposit of £3 is then refunded.

Fees of 10s. for medical attendance and 4s. for medicine are also payable in advance. These fees are paid by all students whether the attendance and medicine are required or not, but no matter to what extent they are required no further charge is made.

Upon a student entering the College the fees and deposits for the first session are as follows :—

	£	s.	d.
Education and Maintenance fee	12	10	0
Medical Fee	0	10	0
Druggist's Fee	0	4	0
General Deposit	3	0	0
	16	4	0

Non-resident students may be admitted on the approval of the Minister. The fee for these students will be £2 2s. per annum, payable half-yearly in advance.

Special Courses and Special Fees.

A limited number of non-resident students, male and female, may be received at the College for a term of six months for instruction in the following special courses :—

Poultry and Bee Farming.
Dairying in all its branches.
General Orchard Work.
Pig Farming and Bacon-curing.

The fee for any special course shall be £2 2s., payable in advance.

A special course cannot be taken during the currency of the general College course.

A limited number of special course students may be admitted to residence on payment of full College fee.

Bursaries.

Six bursaries of £25 a year each may be awarded by the Minister for Mines and Agriculture, each year, to those students whose parents' circumstances and their own aptitude and qualifications render them deserving of this assistance. Special application must be made for these bursaries before the commencement of the College term.

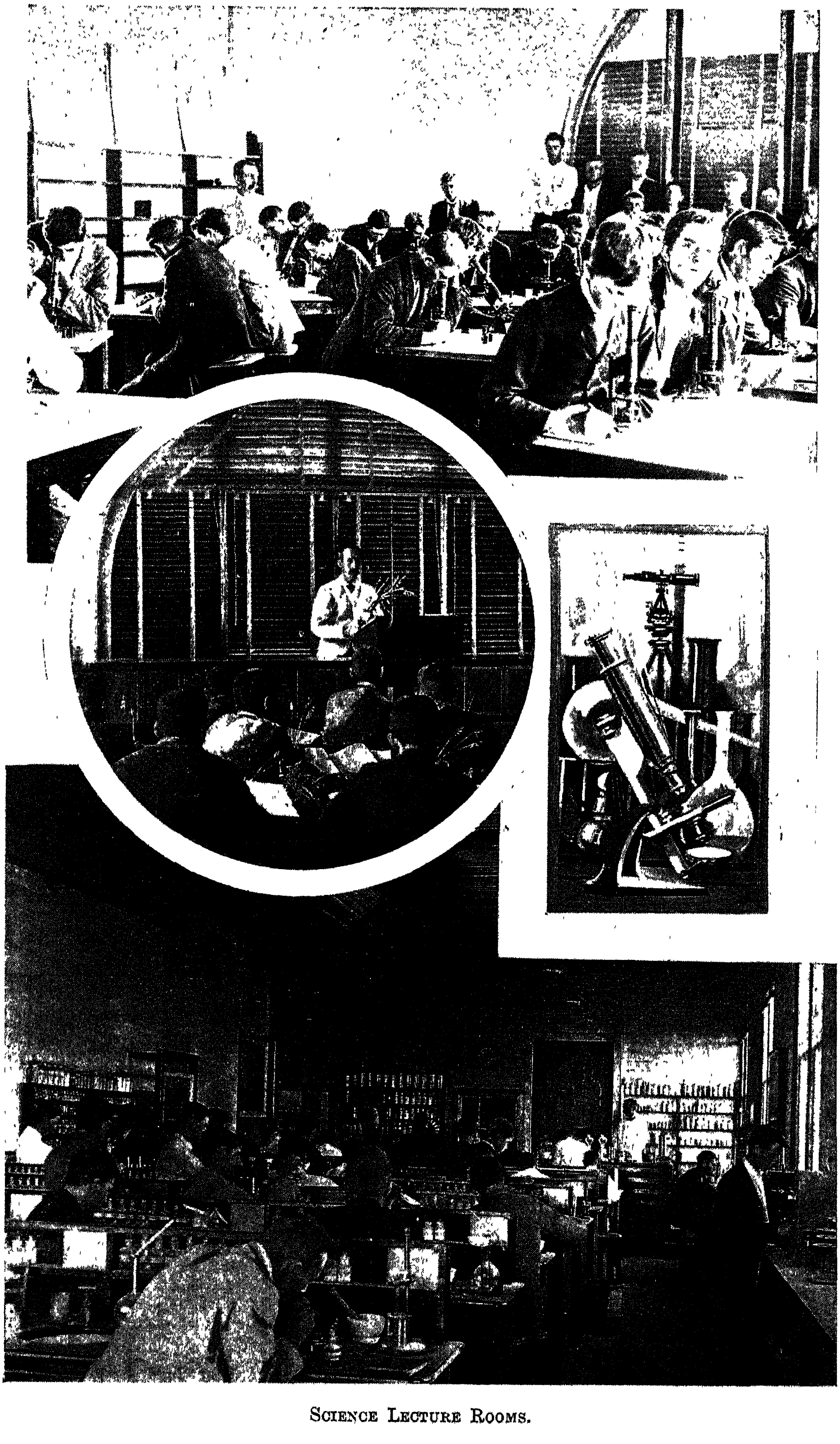
Medals and other Prizes.

The Minister's Special Prize for best farm student.

The Principal's gold medal to the dux of the College.

The Burdekin silver medal presented to each student upon taking his diploma. (Sydney Burdekin, Esq., has arranged that this tangible expression of his appreciation of the work of this Institution shall be available for all time.)

The Burdekin book prizes; also a number of book prizes presented by the parents and friends.



Science Lecture Rooms.

Students' Outfit.

Each resident student will require to provide himself with the following articles :—

Two suits working clothes.
One suit for Sunday wear.
Two pairs suitable boots and one pair slippers.
Hair brush and comb.
One clothes-brush.
Four sheets.
Three pillow slips.
Six strong bath towels.
Two large aprons for the chemical laboratory.
Set of mosquito nets.

All wearing apparel, bed linen, &c., must be distinctly marked with the name of the student, otherwise it will not be taken to the laundry.

College Sessions.

The academic year will be divided into two sessions :—

The first session, commences January 23rd, and ends June 22nd.
The second session, commences July 23rd, and ends December 22nd.

Notice of Leaving College.

In the event of any student desiring to leave the College before the expiration of the complete course, one month's notice in writing must be given to the Principal, or, in default, a session's fee will be incurred, and be recoverable.

Discipline.

Each student shall conform to the rules and regulations for the time being in force for the government and management of the College, under penalty of expulsion, or of such lesser punishment as the Principal may impose.

Library.

Students may obtain books from the College Library upon application to the Librarian. Books damaged or lost will be charged in full to the student responsible.

Regulations.

1. College students will be required to work on alternate days on the farm and in the class-rooms and laboratories as directed.

2. During the first year of the course the following subjects will be studied :—

Practical Agriculture, Principles of Agriculture, Practical Chemistry, Theoretical Chemistry, Botany (including Vegetable Pathology), Arithmetic and English, and Surveying.

3. An examination for the first year's certificate will be held at the end of the student's first year, to get which he must obtain 50 per cent. of the maximum marks in the following subjects :—

Principles of Agriculture, Practical Chemistry, Theoretical Chemistry, Botany; and 75 per cent. in Practical Agriculture.

4. During the second year the following will be the subjects of study :—

Practical Agriculture, Principles of Agriculture, Practical Chemistry, Theoretical Chemistry, Entomology, Veterinary Science and Practice, Book-keeping, Botany (including Vegetable Pathology), and Mechanics (including Heat).

5. The examination for the diploma will take place in December each year, and to obtain a diploma a student must pass examinations in—

1. Practical Agriculture.
2. Principles of Agriculture.
3. Practical Chemistry.
4. Theoretical Chemistry.
5. Botany (including Vegetable Pathology).

And any three of the following subjects:—

6. Applied Mechanics and Heat.
7. Entomology.
8. Book-keeping.
9. Veterinary Science and Practice.
10. Surveying.
11. Sheep and Wool.

The paper in Surveying is set at the first year examination and is available for the diploma. In order to obtain the diploma the student must secure at least 75 per cent. of the General Conduct marks and 75 per cent. of the maximum marks in Practical Agriculture, the standard for a pass in all other subjects being 50 per cent.

6. The diploma will not be granted to students obtaining less than 75 per cent. of the General Conduct marks, and all claim to medals, prizes, and certificates for the current session will be forfeited.

7. Examinations in all the subjects of the College course will be held weekly on Saturday forenoons, and at such other times as may be deemed necessary by the teaching staff, and approved by the Principal.

8. The Principal will allot to officers their respective duties in the College and on the farm, and will have power to frame rules and regulations for the guidance of the students and all engaged in the College and on the farm. Such rules and regulations to be subject to the approval of the Minister.

Working Hours.

The hours of labour on the farm and in the workshops are to be 48 actual, as follows:—

Monday ...	... 7 to 11·30 a.m., 1 to 5 p.m.,	8½	hours.
Tuesday ...	... 7 to 11·30 a.m., 1 to 5 p.m.,	8½	,,
Wednesday ...	... 7 to 11·30 a.m., 1 to 5 p.m.,	8½	,,
Thursday ...	... 7 to 11·30 a.m., 1 to 5 p.m.,	8½	,,
Friday ...	... 7 to 11·30 a.m., 1 to 5 p.m.,	8½	,,
Saturday ...	... 7 a.m. to 12·30 p.m. ...	5½	,,
		48	hours.

The above hours shall apply only to the usual routine work of the farm. During the time of sowing and harvesting, such instructions as are necessary will be issued by the Principal.

College Rules.

1. Students are required to obey the orders of the Principal, teaching staff, and those put in charge of them for the day.

2. Lecture and demonstration hours will be from 8·30 to 11·40 a.m., and from 1 to 5 p.m.; five minutes being allowed between each lecture.

3. In the event of a lecturer being unable to deliver his lecture or carry on a class, the students concerned are to devote their time to such work as the Principal may direct.

4. Students are not to occupy the class-rooms or laboratories, except during lecture hours and evening study, and then under the constant supervision of one of the officers.

5. Students will not be allowed to wear slippers during lectures. They must appear neat and tidy, and no coats may be taken off without the permission of the lecturer.

6. When any student is excused, through illness, from attending any lecture, class, or practical work, he is not to go beyond the bounds fixed by the Principal.

7. Punctuality, order, and quietness are to be observed in the College and on the farm at all times. Unpunctuality, disorder, and noise will render students liable to lose good-conduct marks, or to be dealt with in such other way as the Principal may determine.

8. Students must attend punctually at all meals, and must appear at the table clean and tidy; quietness and order must be observed. They will lose good-conduct marks if late, unless detained in the College or on the farm. Students late for meals must be satisfied with whatever the housekeeper can give them.

9. Students (except in cases of sickness) may not be absent without permission.

10. All games are expressly forbidden during the hours specified for lectures or classes. The piano must not be used during class or study hours.

11. Students smoking in bedrooms, or using lights of any description therein other than those provided by the Department, are liable to instant dismissal. The habit of smoking is expressly discountenanced, and is prohibited, except in places set apart for the purpose.

12. Students are not allowed to frequent hotels in the town unless accompanied by parents or guardians.

13. Students may not bring, or cause to be brought, into the College buildings or on to the farm any fermented or spirituous liquors.

14. Students must not have in their possession firearms of any description.

15. No student is allowed to change his room without permission. At the close of a session senior students will have preference as to the choice of any vacant rooms.

16. Students will not be allowed leave of absence during the session except on important occasions, and with the full consent of their parents in writing.

17. Students may leave the College bounds after 8 p.m., provided their general conduct is satisfactory; but they must be in their rooms not later than 10·30 p.m., unless special permission is granted by the Principal.

18. Each student is required to keep a farm journal from personal observation.

19. Students required to take charge of working horses are to be at the stable at the time shown on the College time-table; and are required to clean and otherwise attend to them.

20. Students required for ordinary farm work are to assemble as indicated on the College time-table, at 7 o'clock a.m. sharp, to receive instructions.

21. Students in charge of animals are expected to treat them in a humane manner.

22. All cases of injury to animals and implements are to be reported without delay to the Principal.

23. Students using tools and failing to return them to their proper places will be held responsible, and any student damaging implements, harness, gates, or other property on the farm through carelessness or neglect will

have to make the same good at his own expense. All such losses and breakages must be at once reported to the Principal.

24. Cows are to be milked by students in turn, as may be directed.

25. It is expected that all students will give timely notice to the Principal regarding the straying of stock, &c., and show generally an interest in the well-being of the farm.

26. Students are invited to question the workmen on the farm on matters pertaining to the work, implements, &c.

27. No student will be permitted to enter the orchard or vineyard without the consent of the Principal, unless in charge of one of the teaching staff for educational purposes, or when at work with the orchardist.

28. Students are allowed access to all other parts of the farm, but they are required not to disturb the stock or leave any of the gates open.

29. Students are forbidden to enter the kitchen or laundry, except on business.

30. Students are cautioned against interfering in any domestic arrangements, and finding fault with the servants. Should there be any cause of complaint they are requested to speak to the Principal upon the subject.

31. Any student incapacitated by sickness and away from duty for more than two days consecutively, must call in a medical man, and if he certifies that the student is in a fit condition to be moved, he must go home to his parents or guardians, or to some suitable place for the purpose of obtaining proper attention, unless special permission to remain be obtained from the Principal. Although every attention will be paid to sick students in cases of sudden illness, it must be distinctly understood that the Department does not bind itself in any way to provide nursing and medical comforts.

32. All students must attend Divine Service once each Sunday.

33. No Student is allowed to bring any horse, dog, or other animal to the College or farm.

34. Visitors are not allowed to inspect the buildings or attend meals without permission from the Principal.

35. Complaints, arising from any cause whatever, are to be made to the Principal.

36. Any student who is guilty, either within or without the College, of profane, immoral, or insubordinate conduct, or who after admonition wilfully breaks any of the rules of the College, or persistently neglects his studies, is liable to dismissal by the Principal.

37. The Principal may at the close of any session direct that any student whose retention is likely to be unprofitable to the student himself, or injurious to other students, or prejudicial to the discipline or the reputation of the Institution, be not permitted to return, and therefore such student's name shall be removed from the College roll.

Forms of Application for Admission into the College.

(*For candidates under* 21 *years of age.*)

189 .

I HEREBY apply for the admission of my as a student into the Hawkesbury Agricultural College of New South Wales, on the basis of the Prospectus issued by the Minister for Mines and Agriculture, showing the conditions under which students will be admitted thereto ; and I undertake that he shall at all times conform to and obey the rules and regulations for the time being in force for the government and management of the said

The Dairy.

College, and I agree that his continuance as a student at the College shall be conditional upon his compliance with all such rules and regulations.

(*Signature of Parent or Guardian.*)

(*Full Signature of Candidate.*)

The parent or guardian of the candidate for admission as a student into the Hawkesbury Agricultural College is required to supply the following particulars:—

Candidate's age, and date of last birthday.
Name of last school and date of leaving.
Previous occupation, if any.
Standard of education—indicating what educational certificates have been gained; and the position attained in the last school.

(*Signature.*)

NOTE.—This form must be accompanied by a certificate of character from a responsible person, and a medical certificate as to health.

(*For candidates of* 21 *years, and upwards, of age.*)

189 .

I HEREBY apply for admission as a student into the Hawkesbury Agricultural College of New South Wales, on the basis of the Prospectus issued by the Minister for Mines and Agriculture, showing the conditions under which students will be admitted thereto; and I undertake at all times to conform to and obey the rules and regulations for the time-being in force for the government and management of the said College, and I agree that my continuance as a student at the College shall be conditional upon my compliance with all such rules and regulations.

(*Full Signature of Candidate.*)

The candidate for admission as a student into the Hawkesbury Agricultural College is required to supply the following particulars:—

Age, and date of last birthday.
Name of last school and date of leaving.
Previous occupation, if any.
Standard of education—indicating what educational certificates have been gained; and the position attained in the last school.

(*Signature.*)

NOTE.—This form must be accompanied by a certificate of character from a responsible person, and a medical certificate as to health.

College Lecturers.

Agriculture and allied subjects	The Principal, Mr. George Valder.
Theoretical Chemistry Practical Chemistry Surveying and Mensuration Applied Mechanics and Heat	The Science Master, Mr. E. C. Wood, M.A., B.Sc., B.E.
Botany Vegetable Pathology Agricultural Entomology Book-keeping Arithmetic and English	The English Master, Mr. C. T. Musson, F.L.S.

Visiting Lecturers.

Veterinary Science and Practice	Mr. S. C. Pottie, M.R.C.V.S.
Sheep and Wool	Mr. A. Hawkesworth.

The Dairy, Fruit, and Viticultural Experts to the Department also occasionally visit the College and give demonstrations and lectures.

TEXT BOOKS.

STUDENTS on entering the College will require the following books, which can be purchased at the College:—

The Farmers' and Fruit Growers' Guide	1	0
Fream's Elements of Agriculture	3	6
Roscoe's Chemistry	4	6
Johnson's Elements of Agricultural Chemistry	6	6
J. W. Oliver's Elementary Botany	2	0
Marshall Ward's Diseases of Plants	2	6
	£1 0	0

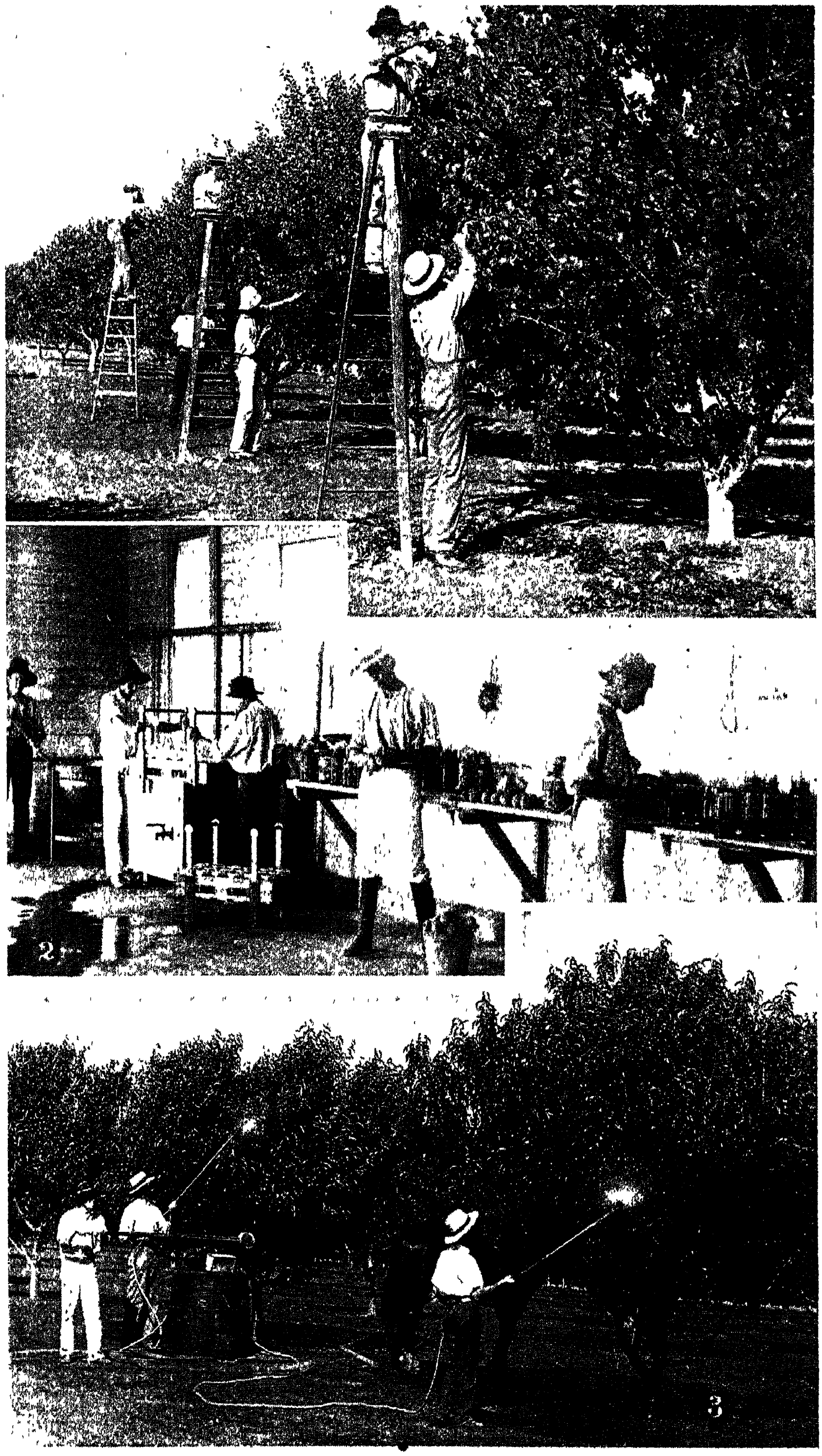
Information will be given at the College regarding books for the second year's study.

Books of reference for wider study can be obtained from the Library.

Time-table (Fortnightly).

Year.		8·30—9·30.	9·30—10·30.	10·30—11·30.	1—3.	3—5.	7—8.
2nd	MON.	Agri.	Chem.	Entom.	Book-keeping.	Prac. Chem.	Study.
1st	TUES.	Agri.	Chem.	Bot.	Prac. Chem.	Bot. Laboratary.	Study.
2nd	WED.	Vet. Science and Practice.			Wool-classing, 1—4		Study.
1st	THURS.	Agri.	Chem.	Arith.	Veg. Path.	Prac. Chem.	Study.
2nd	FRI.	Agri.	Engineering.	Ent.	Prac. Chem.	Book-keeping.	Study.
1st	SAT.	Examinations.					

Year.		8·30—9·30.	9·30—10·30.	10·30—11·30.	1—3.	3—5.	7—8.
1st	MON.	Agri.	Chem.	Bot.	Bot. Lab.	Prac. Chem.	Study.
2nd	TUES.	Agri.	Chem.	Ent.	Prac. Chem.	Book-keeping.	Study.
1st	WED.	Surveying.			Ent., 1—2	Field Bot., 2—4	Study.
2nd	THURS.	Agri.	Engineering.	Bot. & Veg. P.	Book-keeping.	Prac. Chem.	Study.
1st	FRI.	Agri.	Chem.	English.	Prac. Chem.	Veg. Path.	Study.
2nd	SAT.	Examinations.					



THE ORCHARD AND CANNERY.

Syllabus of Instruction.

Agriculture.

Ancient and modern literature of agriculture; its object and leading principles. Influence of science on agricultural industry. Systems of farming.

The Soil and its Preparation.

Influence of physical characters of various districts on soils; classification of soils; the physical properties of sand, clay, lime, and vegetable matter; good, bad, fertile, and infertile soils; their impoverishment and exhaustion; capabilities; value and improvement of soils; preparation and cultivation under various conditions for different crops; subsoiling; deep cultivation; tillage, drainage, and manurial operations; burning, claying, liming, and mixing of soils; object, times, methods, and cost per acre; special requirements for arable, dairy, and grazing purposes; effects of tillage, planting, and varying seasons on the soil; effect of fallowing; reclaiming of waste land.

Implements of the Farm.

Economy in labour; relative advantages of different powers used—hand, wind, water, steam, and horse; various instruments used on a farm—their points of excellence, cost, management, and preservation; hand ploughs, swing, wheel, double furrow, and multiple ploughs, stump-jumping, subsoiling, and draining ploughs; harrows, scarifiers, and rollers; steam cultivation; planting and sowing machines, hoeing, harvesting machinery, ancient and modern; reapers, reapers and binders, stripper, threshing and dressing machines, barn implements and machines, implements and machines used in stock-feeding, weighing machines, hay presses, stack building and thatching, carts, waggons, and minor appliances of the farm, traction engine, &c.

Drainage.

Land drainage, its importance, principles, systems, materials and implements, cost and effects, increased value of land, and benefits as regards the health of inhabitants and increase of production.

Irrigation.

Ancient use of; present methods, appliances used, effect on the value of land, and health of inhabitants, its importance in Australia.

Farm Buildings, &c.

Homestead, position and aspect, buildings required, materials; construction, shelter, valuation, maintenance and repair, drainage and ventilation, cottages, yards, roads and road-making, fences, fixed and movable, the various kinds and their cost, live fences, hedges, &c.; value of subdivision, gates; ponds, dams, tanks, artesian and other wells, and other matters regarding general water supply; swing gates, drafting-yards, earth scoops, windmills, pumps, farm steam engines, &c.

Manures and Manuring.

Use and management of manures; their respective money value, application, and adulterations; farm-yard manure and the conditions which influence its quality; liquid, sewage, nightsoil, green crops ploughed in, sea-weed, lime, gypsum, ashes, potash salts, Thomas' phosphate powder, sulphate of ammonia and nitrate of soda, salt, soot, bone-dust, blood manure, sheep droppings, guano, superphosphate, tanners' refuse, composts, refuse cakes, artificial manures, &c.

Cultivation of Crops.—Principle of rotation of crops; plant food, cereal, leguminose, and root crops, herbage and fodder crops, industrial crops, suitability of soil and climate to be considered, uses of catch crops, origin, characteristics, cultivation, management, harvesting, cost of production, uses and marketing of various crops, the weeds of the farm.

Culture of Grass Land.—Various kinds of pasture, improvement of poor grass land, laying down of permanent pastures; the most useful grasses, indigenous and introduced, their characteristics described; injurious grasses, hay and hay-making, stacking and thatching, pressing; special fodder plants.

Leguminous Fodder Plants.—Vetches, clovers, trefoils, sainfoin, cow-pea, lupin, tagosaste, carob bean, &c.; with special attention to the cultivation of lucerne; preparation of land, sowing, uses for hay, silage &c.; exhaustive nature of certain crops; pulse crops; cultivation of peas, beans, gram, chick-pea, cow-pea, &c.

Cereal Crops.—Origin and characteristics and cultivation of wheat, barley, oats, rye, and maize; harvesting, its times and methods; stacking and thatching, threshing, yield, preparation for market, storage, imports and exports, statistics, importance, cultivation of rice, sorghum, sugar-cane, millets, broom corn, &c.; hybridisation; uses of some of the above-mentioned crops for hay and silage.

Root Crops.—Cultivation of potatoes, turnips, mangold, beet, carrots, parsnips, chicory, artichokes, &c.

Field Vegetables.—Importance and uses, crops suitable, storage and sale; cabbages, kohl rabi, Jersey tree kale, 1,000 headed kale, prickly comfrey, &c.

Seeds.—Their identification, selection, and treatment before sowing, germinating power, effect of age, liability to disease, adulteration, quantity of seed for sowing, time and methods of sowing.

Special Products.—Cultivation of New Zealand flax, common flax, hemp, buckwheat, arrowroot, wattles, hops, tobacco, the olive, castor-oil plant (making of oil), rape and mustard, medicinal and perfumery plants, and any new products that may from time to time be introduced.

Silos and Ensilage.—Soiling, &c.

Origin of the system, its importance, forms of silos, crops for the silo, harvesting, filling and weighting, sweet and sour ensilage, stack ensilage, practical results, its value for milch cows; soiling, its advantages and disadvantages.

THE VINEYARD AND FRUIT PRESERVING SHEDS.

Orchards.

Laying out and cultivation of an orchard; fruit best suited for general purposes and export, climate to be considered; best methods of cultivation; propagation and management of fruit-trees and bushes; grafting, budding, planting, transplanting, pruning, picking, storing, marketing, jam-making; chief and most useful kinds of stone fruits, pomes, and oranges; cider and perry manufacture. The fig, its culture, drying, &c. Fruit canning, &c.

Vineyards.

The vine, origin and uses; preparation and cultivation of land, seeds, cuttings, rooted vines, care, pruning, training, and general management. The chief diseases of vines, their prevention and cure. Wine-making and raisin-drying.

Arboriculture.

Importance of the subject and its special application to New South Wales, objects of tree-planting, shelter, regulation of temperature and rainfall, ornament and profit; preparation of land, selection of trees, care when young, planting, after management, adaptability of soils and climate to rapid results; indigenous and exotic trees, ringbarking and clearing, cost and effects.

Experimental Plots.

Last season's experiments with crops and animals, treatment and results, produce and cost, liability to disease, effects of various manures on different crops; lessons to be learned therefrom.

Live Stock.

Breeding, rearing, feeding, and improvement of stock, general management, comparison of different breeds as to frame, constitution, and suitability for various purposes.

Horses.—Origin, history, external form, points, characteristics, dentition, breeding, rearing, training, feeding, and general management of the chief breeds of horses—Clydesdale, Shire horse, Lincoln, Suffolk punch, Percheron, Cleveland Bay, thoroughbred, trotter, general purposes horse, Indian remounts, hackney, lady's horse; various breeds of ponies; stables, and stable routine; grooming, clipping, and shoeing, harness and harnessing, yoking and driving, work and cost; pedigree, import and export, sale. Some of the common diseases of horses, their treatment, prevention, and cure.

Cattle.—Origin, external form, points, characteristics, breeding, rearing, dentition, selection and purchase, feeding, and general management of the chief breeds of cattle. Dishorning and spaying.

Breeds.—Longhorns, Shorthorns, Herefords, Devons, Polled Angus, Red polls, Galloway and Welsh cattle, Suffolk and Norfolk polled, West Highland, Ayrshire, Channel Island, Holsteins, Illawarra, Brittany, Welsh, Kerry, and Dexter Kerry.

Housing, cleaning, rearing of calves, stores, branding, castrating, fattening, slaughtering, preparation for market, sale and current prices. Some of the common diseases of cattle, their treatment, prevention, and cure.

Sheep.

Origin, external form, points, characteristics, breeding, rearing, dentition, feeding and general management of the chief breeds of sheep. Fine wool-producing sheep; coarse wool-producing sheep. Merinos, Crossbreds, Lincolns, Leicesters, Southdowns, Romney Marsh, Devon, Dorset, Cotswolds, Cheviots, Hampshire, Shropshire, Oxford Downs, Blackfaced Highland, Comebacks, &c. Peculiarities of district as affecting sheep; management; grasses they prefer; crosses between different breeds; importance and value of wool; shearing, management of wool clip, quality, quantity, classing the fleeces, uses of different classes of wool, greasy and scoured wool, lambing and weaning, management of lambs, cutting and marking, washing and drafting, dipping and branding, marks denoting age, names at different ages, number per acre, average weight, fattening, slaughtering, preparation for market, trucking; sheep farming in Australia and other countries; annual clip of wool, export, value and future prospects. The effect of grazing sheep on the soil. The sheep dog, its use and abuse. Common diseases of sheep, their treatment, prevention, and cure.

Special attention is paid to the system of topping off sheep for export.

Pigs.

Origin, points, characteristics, breeding, rearing, dentition, and general management of various breeds of pigs; Berkshire, Poland-China, Yorkshire, Tamworth, Cheshire, Essex, Devon and Dorset breeds; number per acre; housing, ringing, spaying, cleaning, feeding, and fattening; stores, porkers; management of brood sows; sucking pigs; killing and cutting up; bacon curing; marketing and current prices; profits in pig breeding; pigs in connection with the dairy.

Construction of piggeries; drafting and loading yards. Common diseases of pigs, their treatment, prevention, and cure.

Poultry.

Origin, history, characteristics, breeding, rearing, feeding, fattening, and general management of the chief table and laying breeds of fowls, ducks, geese, turkeys, and capons.

Construction of fowl-houses, coops, &c.; incubators and their management; the sitting hen; storing eggs; marketing; exportation of poultry and eggs.

Bees.

Origin, history, physiology, characteristics, and general management of bees. Hives, ancient and modern; construction of the apiary. The Ligurian, Cyprian, Australian, and other varieties of bees; the honey extractor; the value of bees in the fertilisation of plants.

The Dairy.

Its construction and temperature; utensils, implements, and machinery; their kinds, care, and preservation; selection of pastures for milk, butter, and cheese. Forage crops; conservation of fodder. Selection of animals; breeding, feeding, milking, and general management.

Milk and its properties; influence of breed, food, and climate on quantity and quality of milk; milk testing and milk-testing machines, refrigerators, yield; cream separators, management of cream, skimmed milk, aeration, cooling, Pasteurizing, sterilizing, and preserving; carriage and marketing.

Butter.—Treatment of cream, its Pasteurization and ripening by lactic ferment; characteristics of good butter, and circumstances affecting it; its manufacture, churns and churning yield, keeping qualities, colouring, preservatives, washing, salting, packing, marketing, export, cost and value.

Cheese.—Characteristics of good cheese, and circumstances affecting it; varieties of cheese, systems of manufacture, flavour, appearance, storing, ripening, packing, marketing, export and import, cost and value; Rennet and its nature.

Business management of the Farm.

Various kinds of farms; arable, pasture and mixed; choice of a farm; value of land; buying or renting; stocking; capital and expenditure necessary; tenants and tenants' rights; landlord and tenant; leases, agreements, rent, valuation of stock, improvement, Impounding and Fencing Acts, market; buying and selling, farm diary, statistics as to production; import and export; labour and wages; engaging servants, day-work, task or piece-work; costs of horse and hand labour; contracts for labour; woods and forests; commons and enclosures; repairs; highways, and the right of way and water; the law relating to diseased cattle; dogs and dangerous animals; general information necessary for a young farmer.

Excursions.

From time to time visits are paid to farms, orchards, shows, works, &c., in the neighbourhood, and reports thereon written by the students.

Practical work of the Farm.

Students engage in practical work of all kinds on the College farm, which occupies over 3,500 acres. They are instructed with regard to details connected with same; arrangement and construction of buildings, yards, and fences; construction management, and working of implements and machines; cleaning, feeding, and general management of live stock; identification and selection of seeds; operations taking place on the farm in connection with various products; carpentering, blacksmithing, drainage and orchard work; operations with stock; judging of animals; naming of parts; explanation of good points; examination of various breeds; valuations, experiments, and results; prices current, and all things incidental to the working of a fully equipped farm.

Everything is done that can be thought of, likely to aid students in understanding the general principles of farm management and work, with practical acquaintance in the details of same; cultivation of crops, treatment of stock in health and disease, and the economical carrying on of farm work generally.

EXAMINATIONS FOR DIPLOMA.

Practical Work.

Students entering for the Diploma Examination for practical work upon the farm may be invited to perform either or all of the following work by the practical work examiner:—

1. Milking cows, making butter, use of dairy appliances, and general dairy work.
2. Killing and dressing sheep.
3. Carpentering work, such as mortising and cutting tenons, setting out roof, and general bench work.

4. Blacksmith's work, such as welding iron, making bolts, fitting and putting on horse-shoe.
5. Fencing, mortising posts, putting up wire or other fences.
6. Yoking up and driving bullocks.
7. Garden and orchard work—digging, grafting, budding, laying off land for planting vineyard or orchard.
8. Horse work—ploughing, striking out and finishing, using mowing machine or reaper or binder, manure spreader, discs, horse hoes, &c.
9. Hay loading—the principles of stack building or thatching.
10. Farm implements—the manipulation of any of the farm implements or machinery upon the farm.
11. Engine—driving the steam engine for either the sawing plant or any other machinery, explanation of the working parts, &c.

VIVA VOCE EXAMINATION.

This examination in agriculture may comprise questions within the range of the following subjects:—

1. The soil and its preparation for various crops.
2. Cultivation—sowing and harvesting of various farm crops.
3. Fallowing land and green manuring.
4. Manure and manuring for various farm crops.
5. Cultivation of various products suitable for this Colony.
6. Implements of the farm, their cost and uses.
7. Irrigation for various crops, its importance.
8. Land drainage—its importance, principles, cost, and effects.
9. Farm buildings, fencing, stock and sheep yards, drafting yards, swing gates, slip panels, &c.
10. Silos and silage—origin, importance, crops for sour and sweet silage.
11. The orchard, vineyard, vegetable garden, arboriculture, &c.
12. The dairy—milk, butter, and cheese; judging dairy stock; the escutcheon of the cow, &c.
13. Live stock of the farm—horses, cattle, sheep, pigs, poultry, and bees.
14. Business management of the farm, &c.; book-keeping, &c.

Veterinary Science and Practice.

1. Anatomy of the domestic animals, including organs of the body and their special functions.

2. Diseases most frequently met with in agricultural life other than special diseases.

3. Specific diseases, both those known in the Colony, and those which may sooner or later manifest themselves—*e.g.*, foot and mouth disease, cattle plague, &c.

4. Hereditary diseases, special reference to.

5. Conformation of the horse as pertaining to work and disease.

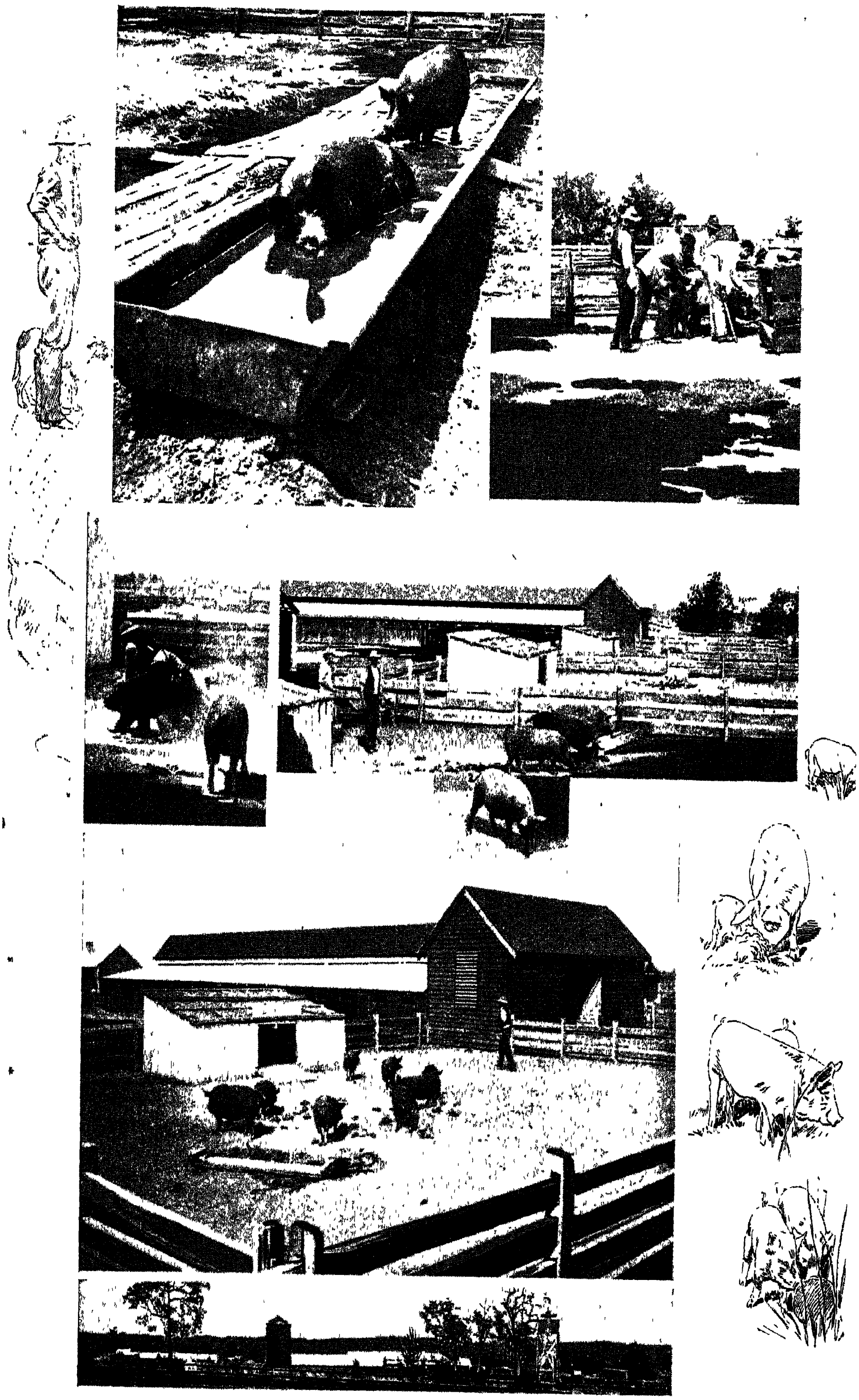
6. How to examine for unsoundness, inspection of meat.

7. Surgery—Operations and instruments; accidents and methods of treatment; horse-shoeing, its importance as to soundness.

8. Materia medica—Their classification, methods of administration, nature and use of medicine and therapeutics.

9. Rudiments of Physiology.

The above relate to the horse, ox, sheep, pig, dog, and fowl. Occasional practical demonstrations and operations will be held.



THE PIGGERY.

SPECIAL DAIRY COURSE.

Practical Work.

Rearing, feeding, milking, and general management of dairy cattle.

The treatment, pasteurisation, separation, and testing of milk; the ripening of cream naturally and artificially; the preparation of lactic ferments (starters) from pure cultures; the manufacture of butter and its preparation for market—both local and foreign.

Cheese-making.—The treatment and ripening of milk both naturally and artificially, the determination of acidity, and the manufacture of cheddar cheese.

Lectures will be delivered upon the above subjects, and on dairy bacteriology.

Examinations will take place during the first week in January and the first week in July.

The practical examination will include dairy-farming, butter-making, and cheese-making; and the theory will include a paper on each of these three subjects. In order to secure a pass, students must obtain 50 per cent. of the maximum marks.

SPECIAL POULTRY COURSE.

Introduction. Classification of breeds—laying breeds, table breeds, general purpose, and other breeds. Waterfowl and turkeys—selection and breeding, houses and housing. Natural and artificial incubation. Rearing of chickens. Hatching and rearing of waterfowl and turkeys. General management of fowls, turkeys, ducks, and geese. Value of foods. The feeding and fattening of poultry. Fattening ducks, geese, and turkeys. Killing and dressing poultry. Marketing eggs and poultry.

Agricultural Chemistry.

Courses of experimental lectures on chemistry, in its relation to agriculture, are delivered to First and Second Year Students.

Practical instruction is also given in the chemical laboratory throughout each year, each student devoting two hours to bench work on two afternoons per week.

THEORETICAL COURSE.

First Year.

General principles of chemistry; chemical action; laws relating to matter; study of typical elements and their common compounds—hydrogen; oxygen; nitrogen; air; water; ammonia; nitric acid; chlorine, bromine, iodine, and fluorine: their acids and oxides—carbon; silicon; boron; coal, coal-gas, and flame; carbonic acid; sulphur; phosphorus; sulphuric and phosphoric acids.

Metals—potassium, sodium, ammonium, calcium, barium, magnesium, zinc, manganese, iron, aluminium, arsenic, lead, silver, copper, mercury, tin.

The common minerals and rocks.

The more important organic compounds—alcohols, ethers, acids, sugars, starch, cellulose, albumin, urea, the natural fats and oils, aromatic compounds, alkaloids, &c.

Second Year.

More extended study of air and water in relation to plant-life. The soil—origin and nature of different soils. Geological agencies. Study of different rocks. Classification of soils. Functions of different soil constituents. Relation to plant life.

The plant—chemical composition; assimilation of food. Functions of different parts of plants.

Operations for improving land—rotation of crops; draining; trenching; irrigating; liming; burning, &c.

Nitrification; leguminous crops in relation to nitrogen. Manuring—stable composts; classification of manures; artificial manures—their manufacture and use; manuring for different crops.

Feeding of stock. Principles of nutrition. Manurial value of foods—fodders, silage, hay, &c.

Chemistry of dairy produce and operations.

Fermentation processes and elementary bacteriological principles in a chemical connection.

PRACTICAL COURSE.

First Year.

Study of reactions of the following bases and acids:—

Potash, soda, ammonia, magnesia, lime, baryta, iron, aluminium, copper, lead.

Hydrochloric, sulphuric, nitric, carbonic, phosphoric, and silicic acids.

Qualitative analysis of simple salts containing the above ingredients, and of mixtures of salts.

Quantitative analysis. Use of balance. Gravimetric determinations of a few simple substances involving general principles, such as:—

Carbonate of lime, sulphate of iron, phosphate of potash, sodium chloride, silicates, &c.

Volumetric determinations involving general principles. Acids and alkalies, sodium chloride, iron, &c. Preparation of standard solutions.

Second Year.

Soil Analysis.—Mechanical silt analysis. Estimation of nitrogen. Determination of iron, lime, magnesia, potash, phosphoric acid, &c.

Milk.—Estimation of total solids. Fat; mineral matters; and any additions and adulterations.

Butter—Fat, water, salt, curd.

Cheese—Fat, water, casein, salt.

Manures.—Blood manure. Determination of nitrogen. Bone-dust—Organic matter, nitrogen, phosphate of lime, insoluble matter, and carbonate of lime.

Lime and limestones.

Mineral phosphates; potash salts; ammonium sulphate.

Nitrate of soda; superphosphates.

Mixed fertilisers containing superphosphate, with insoluble, reverted, and soluble phosphoric acid, and containing nitrogen as ammoniacal, organic and nitric nitrogen.

Waste products used as fertilisers.

Farmyard manure.

Preparations of night-soil; sewage and refuse manures.

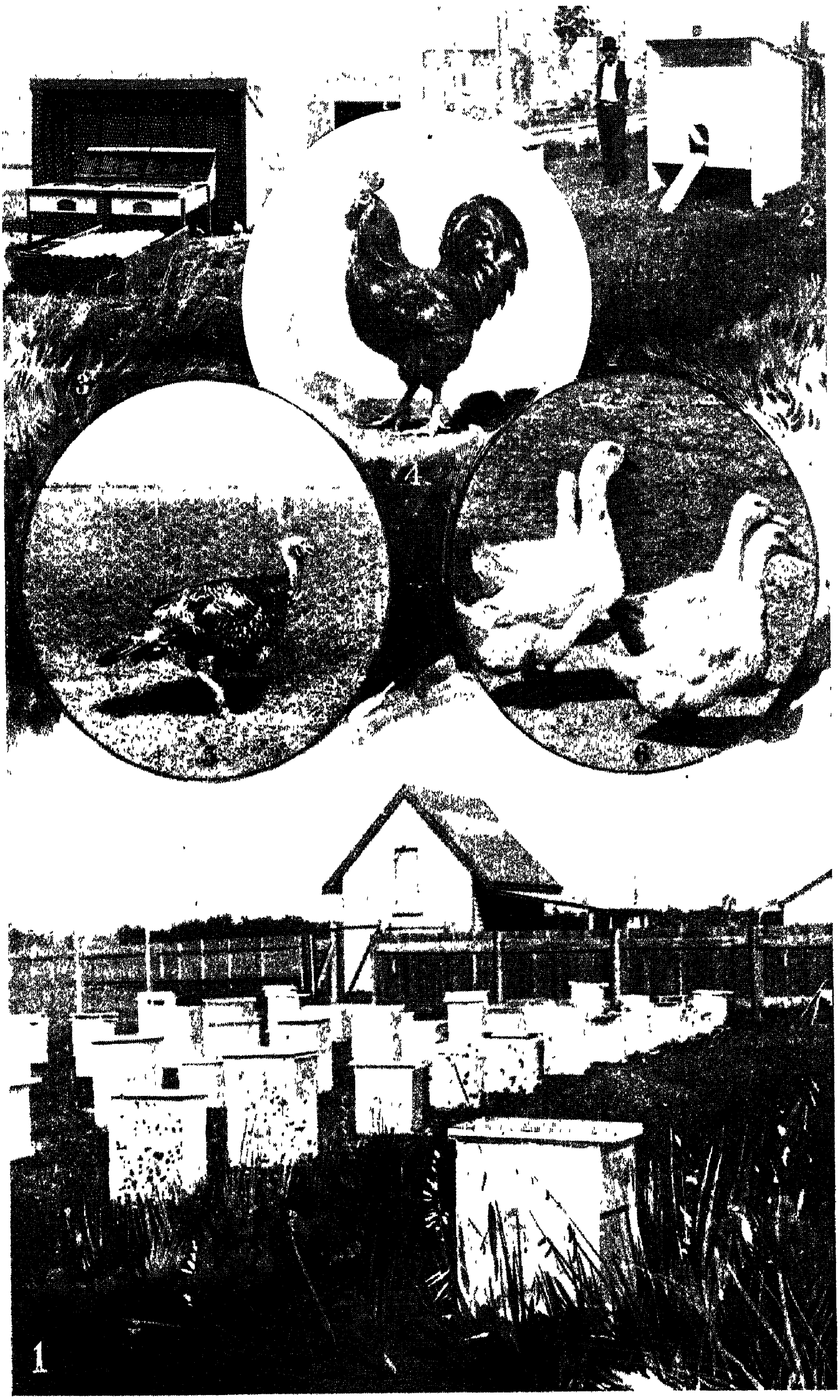
Waters for irrigation, watering stock, and drinking purposes.

Fodders, &c.—Determination of water, fibre, mineral matter, carbohydrates, and proteids.

Hay and silage.

Roots, for feeding value.

Beet and sugar-cane for sugar content, &c.



The Poultry and Bee Farm.

Ashes of plants.
Flour and mill products.
Honey; use of polarimeter.
Wines, spirits, &c.
Substances containing tannin.
Admixtures of animal fats with butter.
Preservative and disinfecting agents, &c.

Each student must provide himself with certain apparatus, &c., required for his individual use, particulars of which are obtainable at the Laboratory.

Agricultural Engineering.

FOR SECOND YEAR STUDENTS.

A course of experimental lectures.

Common properties of matter; solid, liquid, and gaseous states; cohesion, adhesion, porosity, viscosity, &c.

Force, velocity, acceleration, mass, momentum, work, and energy. Graphic methods; units. The laws of motion; inertia. Triangle and parallelogram of forces; principle of moments; centre of gravity; stability; principle of work. The mechanical powers—pulleys; Weston's differential pulley-block; differential screw; velocity ratio; mechanical efficiency; composition of motions and of velocities. Power—horse-power. Centrifugal force—cream separator; Babcock tester; centrifugal desiccators, pumps and fans. Energy; conservation of energy; friction; lubrication, &c.

Intensity of pressure, whole pressure, and transmissibility of pressure in fluids. Artesian wells. Pressures on submerged areas. Bramah press and modifications; hydraulic ram, &c. Barometer; Boyle's Law; suction, lift, and force pumps; siphon. Air-pump. Gauges. Equilibrium of floating bodies. Methods of determining specific gravity. Capillarity, diffusion, &c.

Conduction, convection, radiation, and absorption of heat. Thermometry. Expansion of solids, liquids, and gases. Law of Charles. Specific heat. Latent heat; the physical properties of water; principles of refrigeration. Ebullition—vacuum pans and digesters. Heat a form of energy; mechanical equivalent. Hygrometry; dew, frost, rain, hail, snow; rain-gauges.

Mechanisms, motions of translation and of rotation. Transfer of circular motion; Hooke's joint; toothed wheels; belts; conversion of reciprocating and circular motion. The simple steam engine. Gauge and absolute pressures. Motors suitable for various agricultural purposes. Agricultural machine tools; dairy machinery and appliances.

Building materials. Timber, cast-iron, wrought-iron, and steel, for construction. Brass, gun-metal, &c. Mortar, cement, concrete, and brick work. Stability of structures; foundations; simple triangular frames; graphic constructions for finding stresses in same. Derricks; portable and fixed cranes; sheer-legs; triangular roof trusses; king-post and queen-post roof-trusses.

Agricultural Surveying.

FOR FIRST YEAR STUDENTS.

Tables of weights and measures, English system; outline of the metrical system; certain relations between weights and measures of standard substances, and memoranda for calculations.

Apparatus for weighing and measuring—carpenter's rule, box-tape, capacity measures, &c.

Plumb-line, builder's level, pocket compass.

Division of a straight line into two, or any number of equal parts; bisection of any given angle; to plot a triangle having given the three sides; to find the centre of a given circle.

Areas of rectangles, parallelograms, and triangles, graphic methods and calculation; trapezium, trapezoid.

Relation of circumference to diameter of circle; area of circle; annular rings; areas of sectors and segments of circles.

Ellipse—major and minor axes, area, how to scribe one.

Surface of a sphere, curved surface of a cylinder, and of a cone.

Simpson's rule.

Cubic contents of cylinder, cone, and sphere; round wells, &c.

The prism and prismoid.

Calculations of fuel-stacks in cords, &c.; silos; tanks with side-slopes; circular and rectangular haystacks; cuttings and embankments of earthwork; blue-metal heaps; excavation, timber and builders' quantities, brickwork, masonry; estimating the discharge of water in flumes or open drains.

Gunter's chain; the modern surveyor's chain and its modifications; the arrows; method of chaining—pickets, poles or waddies, alignment, tally; chaining on sloping land, obstacles, notation.

Methods of setting out perpendicular and parallel lines in field; triangle with 3 : 4 : 5 ratio, intersections of equal circles, angle of a semicircle; optical square, cross-staff.

To set out a square of given area.

To set out a given area in the form of a rectangle, with given ratio of dimensions.

To set out a triangle, the area and height or base being given.

To set out circles and annular rings of given areas, &c.

To set out an ellipse of given area and ratio of axes, as, *e.g.*, for a garden bed.

How to make a chain-survey, the principles involved, traverse lines, tie- or proof-lines, off-setting.

Field notes of chain-survey by sketch and column methods; conventional systems of notation for features.

Plotting a chain-survey; calculation of area—how to treat the off-set portions, equalising irregular boundaries, graphic methods.

Ill-conditioned triangles, choice of stations.

Taking angles by chain.

Plane-table surveying.

The prismatic compass; limits to its use; surveying to magnetic meridian; declination.

Plotting a compass survey—the protractor, scales, graphic methods.

Absolute and relative heights, sea-level, figure of the earth, plumb lines, a level surface, apparent and true levels, curvature and refraction.

Various methods and instruments for levelling—the builder's plumb and level, water-level, the barometer, thermometer.

The modern dumpy level; levelling-staff; the temporary and permanent adjustments of the level.

The method of levelling, changing station, curvature and refraction negligible in agricultural work, advantage of approximately equal distances from instrument to staff at back and fore sights.

How to keep the level-book.

How to plot a level section; scales suitable for vertical and horizontal; grading the section for a drain, road, &c.

Calculation of the quantities.

Bench marks; flying sections, trial sections, cross sections, working sections.

Contour surveying, easy methods, how to locate a level line, &c., uses of contour surveys.

Each student must provide himself with the following :—

- 1 surveyor's 10/20 scale.
- 1 small protractor.
- 2 set-squares of 45° and 60° respectively.
- 1 pair compasses (with pencil).
- 1 HHHH Faber's drawing pencil.
- 1 pencil eraser.

Biology.

Will be taken through the two years of residence.

Students begin at once *to observe, compare, and experiment* in the Laboratory and in the field. They will learn to use the microscope, to examine, dissect, identify, and record results by means of drawings, tables, and notes; they will prepare objects for present examination and for permanent storage.

Independent effort and self-reliance will be specially studied; they will investigate for themselves rather than have everything told them.

Senior students will be encouraged to undertake special lines of work.

The work will be mainly done in the Laboratory, though lectures will be given as required, and students will be taught how to make intelligent use of Text Books and works of reference.

(*a*) Botany.

Students are made acquainted with the most useful native and introduced grasses and fodder plants, our weeds, poisonous plants, trees, and principal economic plants.

Examination and testing of seed is largely carried out. Careful study is made of the fungi of economic importance.

The chief points dealt with are as follows :—

Elementary Botany.—Anatomy of Plants: The axis and its appendages. *The root*, its structure, uses, duration. *The stem*, its structure, uses, habits, and modifications; herbs, shrubs, and trees, length of life, annuals, biennials, and perennials; epiphytes, parasites, and saprophytes. *The leaf*, its structure, uses, and modifications; bracts, buds, stipules, tendrils, phyllodes; stomata, transpiration, assimilation, respiration. *The flower*, calyx, corolla, their forms and uses; the chief kinds of inflorescense; colours, nectar; essential organs, stamens, and their structure, pollen; the pistil, ovary, and ovule. *Fruits*, germination, vitality, dispersion and selection of seeds.

Physiology of Plants.—Minute structure, the vegetable cell and its contents; protoplasm, cell sap, chlorophyll; osmose and the circulation of fluids in plants; ingredients in the ash of plants. Plant food, what it is, how absorbed, elaborated, and utilised. Rotation of crops. Reserve materials. Resting periods. Reproduction, cross fertilisation, hybrids; movements; odours. Conditions necessary for healthy growth; variation and the influence of surroundings; selection, natural and human. Principles of grafting, budding, and pruning.

Classification, &c.—Nomenclature, classes, orders, genera, species, varieties. Climate as affecting vegetation; forests. Our indigenous flora and its uses.

Economic Botany:—Consideration of the natural orders containing the chief economic plants.

Leguminosæ.—Fodder plants, pulse crops, wattles.

Graminaceæ.—Fodder grasses, and cereals.

Cruciferæ.—Vegetable producers; cabbage, cauliflower, &c.

Rosaceæ.—The chief fruit-producers; apple, pear, quince, peach, plum, cherry.

Compositæ.—An immense order producing many useful plants and numerous pests.

Aurantiaceæ.—The orange order.

Salsolaceæ.—The native saltbushes.

Myrtaceæ.—Australian timber trees, ironbark, gum, &c.

Viniferæ.—The grape-vine order.

Cucurbitaceæ.—Melon, pumpkin, cucumber.

Solanaceæ.—Potato, tobacco, &c.

Fibre, oil, and perfumery plants; methods of extraction illustrated and explained.

Plants yielding gum, tannic acid, dyes, caoutchouc, insecticides, starch, shortly dealt with.

Bee plants.—Osiers or basket willows, &c.

Plants poisonous to stock or detrimental to agriculturists, examined and identified.

Vegetable Pathology.

Diseases of cultivated plants, due to fungoid or mechanical causes; their nature and diagnosis; full details as to the best treatment for prevention or palliation.

Life history of the chief fungus types.

Bacteria as affecting plants.

Spraying machines.

Fungicides, how to prepare and apply them.

Chiefly laboratory work; a considerable time is devoted to examination into and determination of, the causes of plant disease.

Students should provide themselves with the undermentioned books and materials for botanical work:—

1 pocket magnifying glass; cost, about 3s. 6d.

1 quarto exercise book, strongly bound (without lines if possible), at least 200 pages.

Works of reference are provided in the laboratory and college library.

Zoology.

Mainly Agricultural Entomology.—This subject is studied for the most part in the laboratory by the use of fresh material. The work covers instruction in anatomy, physiology, metamorphosis, habits, classification, and geographical distribution; use of the microscope; examination and determination of specimens. Particular attention is paid to insects and other animals injurious to vegetation; to their natural enemies and parasites, and to the best methods of avoiding or restricting their ravages.

Museum and working collections are formed in order to provide material and familiarise students with the local insects of economic importance.

The chief groups studied are—

Insecta.—*Thysanura*—Spring-tails.
Neuroptera—White ants, dragon flies, lace-wing flies, &c.
Orthoptera—Locusts, cockroaches, crickets.
Hemiptera—Bugs, aphides, scale, phylloxera.
Coleoptera—Beetles, wire worms, weevils, borers, ladybirds, &c.
Lepidoptera—Butterflies and moths.
Diptera—Flies, gnats, sheep-tick, bots.
Hymenoptera—Ants, bees, gall flies, ichneumons.
Arachnida.—Spider mites, cattle and poultry ticks.
Nematoda.—Thread worms.
Trematoda.—Liver fluke.
Myriapoda.—Myriapods (Julus).
Insecticides.—Their effect on insects; *preventives and machinery.*
Friendly insects, fungus diseases.
Farm practice to prevent insect attack.
Quarantine.

Students require a pocket magnifying glass (cost, 3s. 6d.); a quarto exercise book of at least 200 pages.

Farm Book-keeping.

(Double Entry.)

THIRD AND FOURTH SESSIONS.

Importance: uses and methods.
Single entry; double entry.
Description of the various books required.
Day-book, journal, ledger, and subsidiary books.
Capital; assets and liabilities.
Opening and closing the ledger.
Various kinds of accounts—personal, nominal, real, or property.
Profit and loss.
Trial balance, balance sheet.
Taking stock, valuation and depreciation.
Monetary transactions; cash, cheques, Bank notes, bills, promissory notes. Banking; interest, discount; licenses, commission, stamps, credit.
Partnerships—insolvencies and bad debts.
Course of exercises in double entry.
Exercise books will be provided at the College.

English and Arithmetic.

FIRST AND SECOND SESSIONS.

Business letter-writing, essay work and composition, occasional lectures on business habits, trade, climate, statistics, &c.

Arithmetic.—Barnard Smith.

Bee Calendar.

ALBERT GALE.

October.

Last month queen cells were plentiful, and drones were on the wing; but I saw no virgin queens out for marital purposes. Last season in around Sydney swarming was very late indeed; with me it may have been said to have been a failure. All through the past winter pollen was coming in when the days were fine, no doubt the rains contributing to it in conjunction to the mildness of the season, thus greatly aiding the early development of brood. Where my advice has been followed in the matter of keeping the parent swarm well supplied with ample storage during the coldest months of the year, good results should be expected. "Coming events cast their shadows before them," so passing events trail their shadows with them, and also past events must leave their shadows behind them. Therefore, if in the past autumn the bees were well seen to, the effect of that care and attention must have stamped its indications in the shape of very strong stocks; these in their turn must throw off strong swarms. It is only strong colonies that can throw off strong swarms, and it is only strong swarms when hived that can perform an abundance of work; and it is only this abundance of work that greatly aids the queen to lay an abundance of eggs, and an abundance of eggs produce in their turn an abundance of brood, and it is this abundance of brood that compels the workers to do an abundance of foraging; that produces an abundance of stores. It is the abundance of stores that makes the heart of the bee-keeper glad. We are told, "Men do not gather figs from thistles"; neither can we get honey from weak colonies.

Remember the early swarm is always the best. Be satisfied with one, and check all after swarms, or unite them with the weakest ones you have. See that there is sufficient laying space for the queen's purpose. Re-queening should now be in full swing. No queen bee should be permitted to live more than two seasons. Tested queens are fairly cheap now. You will find it cheapest to buy them from queen-raising apiaries, unless you have a large number of colonies to work upon. Certainly there is something very fascinating in raising your own queens. Don't forget that whatever goes wrong with your bees is usually attributable to the queen.

Farm Notes.

NORTHERN RIVERS DISTRICT—September.

H. V. JACKSON.

The days are lengthening, and there is more time in consequence to work upon the crops, keeping down the weeds and cultivating between the rows.

Bulbs of the purple arrowroot (*Canna edulis*), as also the Bermuda arrowroot (*Maranta arundinaceæ*) may be planted. The green leaves of arrowroot are much appreciated by closely yarded or penned fowls, and poultry are also very fond of the white rhizomes of the Bermuda arrowroot.

French beans may be sown, also Lima beans. Sow some blood-red beet. This is an excellent vegetable for the table, but I have been surprised to find there are people who do not know how it should be cooked, and it is owing to that fact I believe it is so little appreciated. The beet should only be well washed, and neither peeled nor scraped before boiling, but boiled whole, thereby retaining the natural juices. If in any way broken they will bleed and be a failure when cooked. After properly boiling, drain off the water, and it will be found the skin will peel off readily when rubbed with a coarse towel.

It can be served either hot or cold, sliced, with a dressing of vinegar, pepper, salt, and sugar. The spinach-beet also should be largely grown in this climate. The green top of this variety is used as a vegetable, being cooked like cabbage. It is really excellent, and stands well through the summer when ordinary cabbage and such like plants are no longer obtainable. It is not advisable to remove all the green top from a plant, but take a few leaves from each beet-plant in the row to make up the quantity each time.

Plant out celery, cabbage, cauliflower, endive, leeks, lettuce, capsicums, egg-plants, and tomatoes. Sow seed of beet, capsicum, carrot, cucumber, egg-plant, melons, parsnip, peas, pumpkins, vegetable-marrow, squash, sweet-corn, tomatoes, turnips, and herbs. Keep the soil well stirred up among vegetables. Give liquid manure to any vegetables that do not appear to be coming on well. If fowls are kept put a quantity of their droppings in a bag and set in a cask of water, and so provide a stock of liquid manure for use from time to time. If the red-beet is coming up too thick in the rows thin the plants out; the thinnings can be planted elsewhere if care is exercised.

Tomatoes may be planted out freely.

Peas should now be abundant. Take care to pull all pods that attain a good size, and do not let any pods ripen until you have decided to let the plants run to seed. So soon as the peas cease bearing dig or plough in the trash. Get your potatoes planted, and

when planting be sure the seed is clean, free from scab or nematode worms.

Fix up low trellis for tomatoes, and large trellis for climbing-beans, passion-vines, as also for chokos, which should by this time be planted. Sow buck-wheat, cattle-melons, chicory, lucerne, and cow-peas.

For green fodder, sow amber cane, planter's friend, sorghum, and millet. Also sow teosinte. Do not forget to put in some large sunflower, the seeds are valuable for fowl-food, and the green sunflower is a valuable addition for the silage stack.

Sow mangolds and turnips; also sow maize for grain and green fodder. Sets of ginger rhizomes, as also tumeric, may be planted in suitable places. Pea-nuts may also be sown. In the cane plantations, work will be in progress getting cane away to the mills. When the cane is off the fields, early preparation should be made to deeply stir the soil, and, if possible, some good fertilisers should be turned under in order to aid the future crop. It may be urged by many that at the price of cane it will not pay to manure the land; but if successful crops are expected in succession, the land must be renovated in some manner, otherwise the cane must deteriorate year by year, for it is a crop that takes a lot out of the land; therefore, the sooner the land is thoroughly ploughed the better, and in the absence of the supply of other manure, sow cow-peas or field-peas, and plough them in later, saving a corner somewhere for seed. Lime will be of much benefit to cane-land, apart from other manures. Cane removes from the soil nitrogen, potash, phosphoric acid, and lime. Manures supplying potash, phosphoric acid, and lime are, therefore, essential, and a leguminous crop, such as cow-peas, is a rapid restorer of nitrogen. Superphosphate manure will give lime, phosphoric acid, and sulphuric acid to the soil. Such a manure is obtainable from Geo. Shirley & Co., Manure Agents, Sydney, in two qualities, the cheapest being £3 13s. per ton. They have also a useful manure for this newly-opened sour land in a pure bone phosphate, grade A, at £3 10s. per ton. Better class manures are, however, obtained in their phosphate potash fertiliser at £4 10s. per ton, and No. 13 grade at £5 12s. 6d. per ton. If, however, the grower considers he cannot avail himself of such manures, perhaps he can yet afford to lime his land and grow cow-peas, in such case, agricultural lime can be obtained at about £1 7s. 6d. per ton in bags f.o.b., Sydney, if more than one ton is purchased, the price will be less; for example, 6 tons would be about £1 2s. 6d. per ton. The Australian Manures' Company also keep a very suitable manure for this land in their grade K, which is quoted at £5 13s. per ton.

Those who desire to attempt coffee-growing, should already have prepared a seed-bed in which to raise seedling coffee-trees for transplanting to the plantation another season. Seedling coffee-trees, coming on from last season's sowing, should be fit for planting out when the tropical rains are prevalent in December and January.

Cuttings of the vines of sweet potatoes should now be planted.

Oats, barley, and rye, intended for hay, if anything like fit, are as well harvested this month; from October onwards thunderstorms are sometimes troublesome. Land should be prepared for planting

bananas, guavas, and pineapples. In the orchard finish planting out orange and lemon trees. Strawberries, loquats, tree tomatoes, and pineapples will now be bearing fruit in this locality. Before the wood buds break deciduous fruit-trees, apple and pear trees, &c., should be well sprayed two or three times with Bordeaux mixture to destroy fungoid diseases. Dust grape-vines with sulphur, even though the leaves have not appeared. Remove suckers from grape-vines, also shoots from fruit-trees. Pruning should have been finished in the orchards. When the blossoms have fallen from the fruit-trees spray with Paris green. Grafting should be completed as soon as possible. In the garden prune bouvardias back. Sow seeds of tender annuals. Go carefully over rose-bushes and thin out the shoots where they are too thick. Now that frosts are over cut back the old growth of cannas, and a fresh growth will be obtained with fine flowers. Old stools of dahlias should have been lifted, and the bulbs divided up, and sets replanted in suitable places. Prune up to shape ornamental shrubs, and clip hedges and ornamental climbing plants. Clumps of chrysanthemums can be lifted and divided up also.

Dairymen occasionally suffer loss through calves becoming indisposed through no apparent cause, and the case is often difficult to diagnose. Such indisposition may arise from a variety of causes or a combination of circumstances, such as unclean and unhealthy quarters, exposure to cold and wet, or to improper or overmuch feeding. A suitable clean warm shed, where calves may make for shelter from cold wind and rain, will be found in most instances the best preventive of ill-health. Unfortunately there is a good deal of thoughtlessness in evidence as regards the treatment of young stock; you will see calves stuck in feeding places where they wallow, lie down and rest, and obtain their food in a pen where the floor is wet slime, decaying manure, and the atmcsphere is fœtid, or otherwise in swampy or wet lands exposed to every wind that blows, it being quite a matter of chance that they survive the ordeal some of them go through when young. In the case of young calves just weaned, suffering from diarrhœa, a simple treatment is to administer 2 oz. of prepared chalk in 1 quart of thin warm gruel of flour and milk every six hours until the symptoms abate; and if in the course of (say) forty-eight hours there is no change for the better, add 1 drachm of laudanum and 1 drachm of powdered ginger to the above. If the illness is severe a dose of castor oil up to half a pint, according to the age and stamina of the animal, may be given; it clears off foul matter, and is soothing to internal sores; then give laudanum, from 2 to 4 drachms, in a drink of warm linseed gruel, with 2 drachms of salicyeate of bismuth. Beware of strong astringents, such as alum. Two ounces of rum or whisky may be given two or three times a day. Where a calf appears to be unwell, it is generally some derangement of the digestive organs. The following prescriptions are also given by various authorities for diarrhœa:—

Pepsine	... 20 grains.
Diluted hydrochloric acid	... 30 minims.
Sulphate of cinchonime...	... 7½ grains.

Water sufficient to mix. To be given twice or thrice daily in (say) 2 pints of thin starch ; or,

Diluted sulphuric acid	30 minims.
Tincture of catechu	2 fluid drachms.
Spirit of chloroform	30 minims.
Water	1 pint.

To be given three or four times daily in thin starch or linseed tea.

If the diarrhœa continues it may end in a bad attack of dysentery, or, as not unfrequently happens, by the time the animal is noticed a form of dysentery has already set in. In such case the animal will be tucked up, the back arched, the coat rough and staring; traces of blood will be noticeable in the evacuations, and sometimes what appear like pieces of membrane. In such cases the following is prescribed :—

Ipecachuana	½ oz.
Powdered opium	2 drachms.
Chalk	2 oz.
Galls	2 oz.

Mix this well together, and give in a pint of warm linseed tea three times a day. Keep the animal in a warm shed, with clean bedding.

RIVERINA DISTRICT.—September.

G. M. McKEOWN.

Pumpkins and Squashes.

May be sown as soon as danger of frost is past. The land should be deeply worked, and well manured. The practice of sowing the seed in raised mounds is in these dry parts inadvisable; sowing "on the flat" being preferable.

For field culture, King of the Mammoths will be found one of the most successful here, it having, during last year's drought, far excelled any other variety in productiveness.

The following varieties for table use were the most successful, viz., Early Orange sugar pumpkin, Delicata, Fordhook, and Hubbard squashes, and Long Bush marrow.

Melons.

Should be sown towards the end of the month, in thoroughly prepared land, which has been well manured. The following varieties will be found among the best, viz., watermelons—Dixie, Kleckley, Sweet Nabob, McIver, and Cuban Queen. Rockmelons—Cassaba, Melrose Banquet, and Netted Gem.

Cattle-melons should also be sown, as they have produced large crops here during dry seasons, when other crops have failed.

Cow-peas.

Should be sown when risk of frost is past. For seed production, the best method of sowing is that of drilling in rows at 3 feet apart, to admit of tillage whilst the crop is growing.

For a crop to be ploughed in or fed off, the seed may be sown broadcast.

Maize.

In favourable seasons, in the deep alluvial soils of this district, fair crops have been obtained, and the prospects of the coming season are hopeful, as good rains have fallen.

This crop forms one of the best for ensilage purposes. Sowing in drills, however, at from 3 to 4 feet apart, with the plants at about a foot apart, will be found the best method.

Lucerne.

May still be sown, but earlier spring sowings are preferable.

Vegetables.

Sow beans of dwarf and running varieties.

Dwarf butter beans, such as Startler and Anderson's Wonder will be found useful varieties, being early and prolific.

Transplant cabbages, Dwarf Drumhead, St. John's Day, and Succession, being among the best kinds for local planting.

Sow tomatoes, and transplant any which are available from previous sowings. Varieties to be recommended, after trials here, are Fordhook First, Trophy, Early Boronia, Duke of York, Beauty, Golden Queen, Honor Bright, Diadem, and Laxton's Early.

HAWKESBURY DISTRICT.—September.

GEO. VALDER.

Maize.

Grain.—The season having been a favourable one, a large area of land has already been prepared for this crop; but those who have not yet ploughed their land should do so soon, as the soil is in very fine condition for farm operations. Early sowing should be made this month; the soil having been so thoroughly saturated, the seed will germinate quickly, and the crops get a good start before the hot

weather sets in. For early crops it seems that ordinary ploughing to a depth of about 6 inches is quite sufficient, as in the cool weather the plants send out the greater portion of their roots into the surface soil, and only commence deep rooting on the approach of hot dry weather. On the other hand, the late crops should be ploughed deeply, as it is advisable to encourage the plants to root deeply right from the start; this is especially necessary in districts subject to drought. On the lighter soils the "listing" system of planting can be strongly recommended, *i.e.*, sowing the seed in the bottom of the furrow; the true "listing" system is simply ploughing furrows the width apart that you intend to place your drills, and not ploughing the rest of the land, simply working with cultivators after the plants are above the ground. On farms where it is intended to plant several varieties, the slow maturing varieties should be planted first, and the quick growing varieties last. Hawkesbury Champion, Golden King, and others of the Yellow Hogan type seem to be holding their own in this district, having given some remarkably good yields the past season. Early Mastodon also gave a splendid return in most instances, but it can hardly be called "early," as it is a very slow-growing variety with us. Ninety Day, Queen of the Prairies, and varieties of those types should be suitable for late sowing.

Maize for Green Fodder and Ensilage.—Sowing should commence this month in order to obtain early supply of green fodder for the dairy cattle, and also to, if possible, get a small ensilage stack or pit ready, so that some silage will be ready in case of a severe winter. Cereals for larger pits or stacks can be put in later on. Drilled maize is much superior to broadcast either for green fodder or for ensilage. For ensilage, maize should be planted nearly if not quite as wide apart as when grown for the grain. Closer planting it is true sometimes gives a greater yield of green fodder, but it is now generally recognised that its feeding value is much increased by allowing the cob to be well formed before cutting, the best time being when it reaches what is termed the glazing period, *i.e.*, when the grain is fairly firm and the skin glazed.

With the view of obtaining new varieties of early maturing maize, and also of other improved varieties, the Department lately imported from the United States a quantity of seed of nine varieties. The greater portion of this seed has been distributed in the maize-growing districts of the Colony, and the remainder will be sown at the different experimental farms. The samples are not nearly equal in quality to the varieties grown here, but it has been noticed that some of the American varieties rapidly improve when cultivated for a year or two in our best maize-growing districts. It is therefore to be expected that among the nine varieties imported we shall find at least one or two that will be equal, if not superior, to the varieties grown here. Careful comparative trials will be made, and if any do prove superior a sufficient area of these varieties will be grown to enable the Department to distribute the seed on a large scale. Although we have some first-class varieties, I feel sure that there is plenty of room for further improvement, and most valuable work can be done in this direction.

Sorghum.

Early sowing of this crop should be made this month. Like maize the drilled crop is far superior to the broadcast. The ordinary maize drills, such as the "Farmer's Friend," are very suitable for sowing sorghum, and with the drills at 3 feet apart will sow 4 lb. of seed to the acre, and the plants will then be quite close enough. Early amber cane yields a very heavy crop, and in feeding trials last season the cows gave better results with this than with any other variety, eating it more readily, and milking better on it. The non-saccharine sorghums, such as Kaffir corn, are not relished nearly as well, and will not compare with amber cane for milk yield.

Millet.

Sowings of Hungarian Millet should be made this month. Being a quick growing crop it forms a very useful early green fodder, coming in much earlier than maize or sorghum. If there is a good supply of green fodders the crop can be left for a while and cut for hay, taking care, however, whether cutting for green food or for hay, that the ears have not burned yellow, as at this stage the little awns with which the ears are covered will often have an irritating effect upon the intestines of the animals eating it.

On farms where sheep are kept it is a good plan, in favourable seasons, to graze off the crop when it is about 8 or 9 inches high. Hungarian Millet stands the feeding and tramping well, and will generally make a strong second growth, and in some seasons can be fed off two or three times.

Mangolds and Sugar Beet.

Mangolds and sugar beet, if not already sown, should be put in at once, the early sown crop being almost always the best. In the coastal districts, sowing on ridges is to be recommended. In nearly all moist climates the ridge system is the best for root crops. During the past season heavy crops of these roots were obtained at many places on the coast and they proved exceedingly valuable to the dairy farmers, &c. Being easily stored they are available right through the winter, and therefore when green fodder runs out can be fed with chaff to great advantage.

Regarding the best variety of mangold, much depends upon the soil. On shallow soils the Globe or Tankard variety do best, Yellow Globe being generally the favourite. For strong deep soil the Mammoth Long Red is the best.

Potatoes.

Potatoes, like mangolds and beet, are best put in either in August or early this month. For this crop the soil requires to be in a high state of fertility in order to obtain the best results. Direct application of fertilisers is very uncertain, except in soils well worn by previous cropping. The best crops are obtained either when planted on land

that has been heavily manured for the previous crop, or when following a leguminous crop. The potato crop in most districts is suffering more and more from disease. Much of this is due to planting affected tubers. None but perfectly sound ones should be used, and if there is any sign of disease among them they should be treated before planting. I notice that, according to the results of some experiments carried out in the U.S. Experimental Station, for wet rot, heating the tubers to a temperature of 105° for four to six hours has a very beneficial effect. Spraying with Bordeaux mixture is also a good remedy for the same disease.

Sweet potatoes.—Tubers should be placed in the seed-bed this month, choosing a warm corner, so that they will sprout quickly and produce cuttings for early planting. On light sandy soils they prove a most valuable crop for the coast, often bringing high prices and being valuable for feeding to stock.

Jerusalem artichokes can also be planted this month. In many soils they yield a very heavy crop of tubers which are valuable for feeding to milch cows and pigs. Turning pigs in on the crops also has a beneficial effect upon many poor rough soils.

Pumpkins and Melons.

Water-melons should receive some attention this month, as much depends upon getting them into the market early. Pumpkins, squashes, grammas, and preserving melons for feed should be planted. These are all useful for stock, &c. Pumpkins, when cut up or put through the root pulper, form a capital feed for dairy cows, and are at all times most useful for sheep, pigs, &c.

For manure,—

500 lb. dried blood,
470 lb. superphosphate,
150 lb. sulphate of potash,

making 10 cwt. Applied at rate of 4 to 4½ cwt. per acre will be a satisfactory dressing, and cost from 26s. to 30s. per acre.

Leguminous Crops.

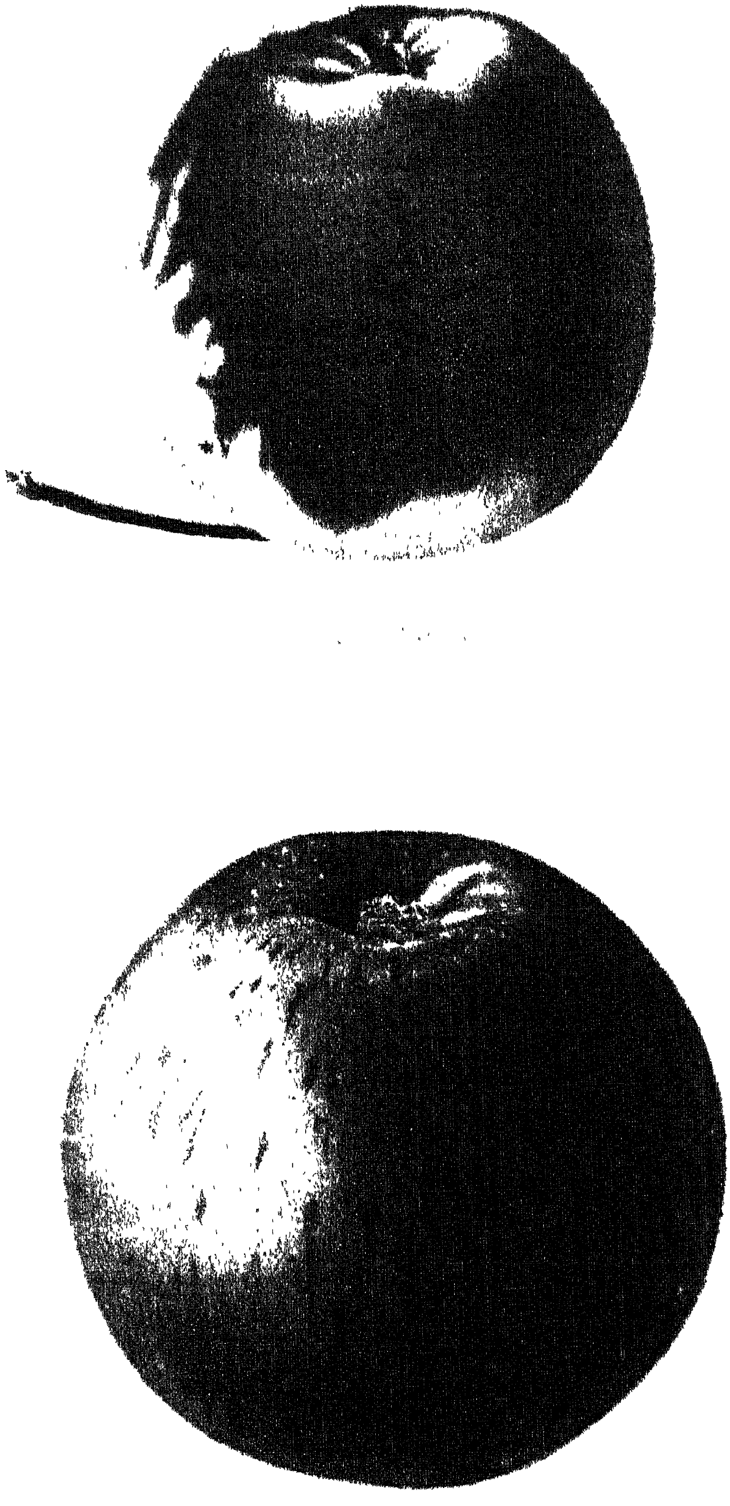
Cow-peas, Lima-beans, Soy-beans, and other leguminous crops suitable for the warm season should be sown at the end of this month.

Lucerne can still be sown, and as the soil has been thoroughly saturated, it should make a rapid growth.

Pea-nuts should receive some attention. In the United States, where they are largely grown, they have proved one of the cheapest and best foods for fattening pigs.

Small Crops.

Small crops, such as buckwheat for bees and poultry, sunflowers for bees, poultry, and fodder, chicory, &c., can now be sown.



ROYAL PEARMAIN

Orchard Notes.

W. J. ALLEN.

THE planting of citrus-trees, disbudding newly-planted deciduous trees, spraying and cultivation are all in full swing during this month, and all require special attention. The cultivator has to be kept going in order to keep the surface soil well pulverised to a depth of from 3 to 5 inches, according to the quality of the soil. Deep soils, where the roots penetrate to a good depth, should always receive deep cultivation, when it will be found that the trees will thrive better and be in a better position to withstand severe droughts, while trees which do not receive this necessary cultivation will not thrive nor will they mature the fruit properly, because, although they may live through the season, the health of the tree is impaired, and while it may be found that should the following be a good season the trees may bloom well, and perhaps set a crop of fruit, in many cases the fruit will never hang to maturity, owing to the fact that the tree is not strong enough to carry it. Therefore, when an orchard is neglected for one year, it usually means that the fruit crop is damaged for two or more years.

In planting citrus-trees be most careful not to plant them any deeper than they were when in the nursery, nor to expose the roots to the sun and wind, as by so doing failure is courted. Of all trees the citrus require most careful handling, especially in our warm districts. Plant only the best kinds, and if the soil on which you are planting is good plant trees which are worked on orange stock.

Citrus-trees may be successfully transplanted at different times of the year, but the best time is when the ground is well warmed, in the spring, and just when the tree is beginning to make its first growth in the spring. Great care, however, must be taken that these trees should not become dry after planting. Cutting back at transplanting should not be neglected, as it is important to cut back the tops so as to compensate for the loss of roots. When once an orange tree is well established it will withstand drought, live, and make stunted growth with poor cultivation, while so-called "hardy" trees would die. At the same time it responds most gratefully to proper treatment.

The Lisbon is still a reliable lemon, and as yet has no proven rival in the Colony.

Preparations will have to be made to keep the codlin moth in check by bandaging the trees, and as soon as the fruit has set on apple and pear trees give a first spraying of summer solution of Bordeaux mixture, Paris green being added in the proportion of 1 lb. to 200 gallons of the mixture. This spraying will be found beneficial for fungus diseases, such as scab, &c., as well as for the codlin moth.

All fruit-trees and vines should have had their winter spraying completed by the first of this month, raisin, grape, and other vines being dressed with sulphate of iron and sulphuric acid solution, and trees with salt, sulphur, and lime.

The manuring of trees and vines, if not already completed, should receive immediate attention, as it is late to apply insoluble manures and derive much benefit from them this season. Soluble manures, such as sulphate of ammonia, nitrate of soda, &c., may be successfully used at this time of the year.

As the Department of Agriculture is supplying a few dormant bud oranges to different fruitgrowers, and as there is a chance that many will not know how to treat same, I insert a couple of illustrations for their guidance. Fig. I is that of the young stock with the dormant bud showing plainly just below the branches—which latter are left on so as to protect the bud in transit. Fig. II shows the branches cut off at time of planting, with about 4 inches of the stem left above the bud. To this the bud is tied when it is a few inches long. If two twigs should start, remove the weaker one, and do not allow any suckers to grow on the stock. This throws all the strength into the bud, which soon become a sturdy little tree. The old wood above the bud should be cut off when the latter is about eighteen inches in length, and the cut covered with grafting-wax. The bud can then be tied to a stake, so as to keep it straight. When it has grown to a height of 2 feet, the top should be pinched back, and a few lateral branches allowed to grow. Up to this time all laterals should be regularly disbudded, leaving only the leaves which grow around the stem, and serve to shade it. Should the dormant bud be planted in an exposed place, it will be well to shade it by driving three palings into the ground around it, or by driving three or four stakes into the ground and stretching hessian around these, leaving the top open. Water the plant at time of planting, and if no rain falls give it a few bucketsful every two or three weeks, until it is well established.

Reference to Coloured Plate.

Royal Pearmain (also known as the *Herefordshire Pearmain*).—Medium in size, round-oblong, approaching obtuse conical; surface mostly covered with indistinct stripes and soft clouds of light red on greenish yellow, which, on ripening, becomes a pale, clear yellow; stalk half an inch long, cavity small; calyx large, open; basin, narrow, plaited; flesh yellowish-white, fine grained, with a pleasant, mild sub-acid, aromatic, fine flavour. Early winter. Best on light soils.

Shockley (also known as *Waddel's Hall*).—Medium, roundish-oblong, narrowing to the eye; yellow-striped and clouded with red, with dark greenish russet blotches; stalk long, slender; cavity narrow, deep; flesh firm, of good but not high flavour. Early winter.

Fig. 1. Fig. 2.

DORMANT BUD ORANGES.

Fig. 1.—Young Stock with Dormant Bud showing just below branches.
Fig. 2.—Showing how branches are cut off at Planting.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of September.

Vegetables.

This is generally considered to be one of the most busy months of the year, when the sowing and planting of all kinds of tender vegetables can be done with safety in all but the very coldest districts of this Colony.

The heavy rains during last month, which have given the soil a thorough soaking in a number of places where a good deal of gardening is carried on, should make vegetable-growing more satisfactory than was the case last season. However, if the ground which has been set apart for vegetables has been indifferently drained, the sooner means be taken to remedy this evil the better, for vegetables will not succeed well with an over-abundance of water about their roots.

Asparagus.—It was advised some time ago to get a portion of land ready for this vegetable, so that everything should be ready by the time planting was advisable. The time has now arrived when asparagus plants may be set out with every chance of their growing successfully.

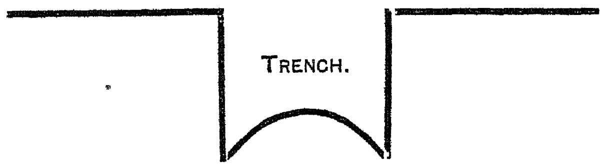
Plants one year old, from the seeds, are perhaps the very best to plant, for there is less chance of their roots being injured than those of the two-year or three-year old clumps, which are very generally used.

You will find that the roots are soft and fleshy, and extremely liable to injury, even when they are taken up with the greatest care. The less the roots are injured the better the asparagus plants will grow and succeed. As some inquiries have been made lately about asparagus-growing, it will be as well to explain the best method of planting somewhat in detail.

The most suitable soil for asparagus is rich, sandy loam, so well drained that there should never be any danger of the roots being affected by wet, or of remaining in a kind of swamp for any length of time, for this would be fatal to them.

Presuming that the intending grower is provided with plants to set out this season, and that his asparagus-bed has been made ready for their reception, shallow trenches should be dug out the full length of the beds, to such a depth that when planted and covered with soil the crowns of the plants shall be from 2 to 3 inches below the surface of the bed. It will be very easy to judge of the depth of the

trench by the size of the plants available. Probably about 5 to 6 inches will be deep enough, and the trench should be made wide enough to allow of the roots being spread out evenly. If the trench be made so that the bottom of it be shaped thus—



the roots can be spread out better than if the bottom were flat. The soil can be rounded in the bottom of the trench as planting proceeds.

As to the distance the plants should stand apart, this is a matter of controversy, some growers advocating 3 feet by 1 foot, others 2 feet by 2 feet, and some even 3 feet by 3 feet. Sometimes the plants are grown in single rows, and this is a system worth considering. As a guide to deciding on the distance apart to plant asparagus, it may be stated that the wider apart the plants are the more space they will have to develop and produce good strong shoots. When the plants are crammed close together, the crowns and roots cannot spread to the extent they should. The better and the richer the soil the wider apart they should be planted.

Whilst asparagus plants are young, and the shoots they make are thin, other kinds of vegetables, such as lettuce, radish, French beans, can be grown between the rows with advantage, and much space saved, but, whatever you do, try to encourage the growth of the asparagus as much as possible, for the greater the number of leaves produced, and the better they grow, the better will be the prospects for future supplies of shoots, and wait until the autumn, when the stems are dead or dying, before you cut them down. It is of great importance that asparagus plants should grow satisfactorily, for if they are blown about and broken down, considerable injury to the stools is caused, because of there being then an insufficiency of leaves to gather and elaborate the plant-food which is stored away by the plants during the autumn for the production of strong shoots in the spring.

The protection of asparagus stems and branches is considered of so much importance in European countries where the best quality of asparagus is produced, that stakes or supports are used to prevent any chance of injury. The plants should be kept quite free from weeds, and only when the rows are planted very wide apart that vegetables may be grown between them.

Well-made asparagus-beds should prove productive for many years—from ten to twenty or thirty. An annual top-dressing of good farm-yard manure, and the application of a dressing of salt occasionally, and a little lime now and then, will be all that is required.

It is an easy vegetable to manage after the first preparations have been completed, so that there should be no excuse for a garden to be without enough plants for the supply of a family. Not a single shoot

should be taken for use the first year, and it would be wise to leave the plants alone the second year, and after that there should be shoots available for use in abundance.

It should have been stated previously that before planting the asparagus plants should be carefully examined, and if any roots are found to be broken, or bruised, or faulty in any way, they should be cut away clean.

In the warm districts old, matured, asparagus plantations should now be producing a good supply of shoots, and will continue to yield for some time, but as soon as you find the shoots becoming weak, cease removing any more, or else the plants will become greatly weakened. Then clear away the weeds, fork up the soil between the plants, spread a mulch over the whole bed, and then the plants should flourish during the summer.

Those who desire to raise young plants for future use can sow seeds at any time during the month in a seed-bed. Sow in little drills, about 2 or 3 inches apart, and sow thinly in the drills, then when the plants come up thin out to about 6 inches apart. Keep them free from weeds.

It may be well to state that this vegetable belongs to the natural order *Liliaceæ*, or lilies, and that it is a native of the sea-coasts in Europe, consequently soil which contains common salt will suit it admirably.

There is a native plant in this Colony belonging to the same natural order which was thought might, under cultivation, be made to produce edible shoots. It is a pretty climbing plant, somewhat, but not very much, like the *Smilax glycyphyla,* known as "sweet tea," or sarsaparilla, and which is used for the same purpose as that medicine.

The botanical name of the plant in question is *Geitonoplesium cymosum.* It bears very pretty bunches of orange-coloured berries, and is common about the coastal districts of this Colony.

Arrowroot.—In warm districts the tubers may now be planted, or old plants may be taken up, divided, and replanted.

The plant known as arrowroot, *Canna edulis,* which is closely allied to and very much resembles the ornamental cannas so well known, is not the true arrowroot, and the starch is not equal to that of the proper kind; but it is an excellent substitute, and is more productive. The true arrowroot is a different species of plant altogether, and will not thrive in many places where the Canna succeeds. It is known as *Maranta arundinacea.* The tubers are much smaller, and of quite a different appearance to those of the Canna. It is a native of the tropical parts of America.

Beans, French or Kidney.—This vegetable may be sown in all districts where frosts are not likely to occur again this season. Any other lenten kinds of beans, such as the scarlet runner, snake bean, Lima bean, may also be sown.

Beet, Red.—Sow a little seed in drills about 1 foot to 18 inches apart. Try the turnip-rooted varieties, which are good and are coming much nto favour. It seems probable that the long-rooted beet will soon e discarded for the globe-shaped varieties.

Beet, Silver.—Prepare some land and sow seed of this useful kind of beet. Manure heavily with farmyard manure. The seed can be sown in a seed-bed, and the young beets afterwards planted in a specially-prepared bed. It is very desirable to have a supply of this useful vegetable for the summer, for it may sometimes be available when no other kinds of vegetables can be had.

Cabbage.—Sow a little seed of the variety known as St. John's Day, which is one of the best cabbages known for summer. Plant out a few young cabbages from the seed-bed. Manure well for this vegetable, and cultivate well during its growth. The better it is cultivated the better it will succeed.

Cauliflower.—Plant out a few strong, young seedlings in very rich soil, but only in the coolest districts of the Colony. They may succeed in the warmer districts, but it is a risk if the summer should prove very hot and dry.

Carrot.—Sow a few rows of various kinds—short, medium, and long. Do not apply manure unless it be old and well decomposed, for new, rank manure causes the carrots to fork and be badly shaped. An old cabbage-bed that had been well manured for cabbages would be a good place to grow carrot, red beet, or other roots.

Celery.—Sow seed in a box or seed-pan, and when the plants are large enough to handle prick them out 2 or 3 inches apart in a small bed prepared for them. Later on, when well grown, they can be planted out in shallow trenches. If any good, strong, young plants can be had, plant them in shallow trenches which have been heavily manured, about 1 foot apart in the trenches.

Cucumber.—Sow seed in any localities when frosts are not likely to occur again this season. Manure well.

Endive.—Sow seed in seed-bed for planting out later on.

Leek.—Sow in seed-bed, and when the plants are about 6 to 8 inches or so in height plant out in rows 18 inches apart, and set the plants about 9 inches from each other in the rows. This plant delights in abundance of rich manure. It can be blanched like celery when the leeks are nearly large enough to pull. Plant deep.

Lettuce.—Sow in drills about 18 inches apart where the plants are to grow, and thin out to about 1 foot apart when the plants are an inch or two in height. Manure heavily with good, well-rotted manure, and do not let the plants have any check until they are ready for table.

Melons, rock and water.—Sow in all warm districts.

Okra or Gumbo.—Sow seed in box or pot or in a seed-bed, and plant out seedlings when they have attained a fair size, about 2 feet apart, in good soil. The succulent pods are useful for thickening soups and stews, as they produce a thick mucilaginous substance.

Onion.—Sow in drills, or plant out young onions which have been raised for the purpose. The land should be well drained, dug up fine, and heavily manured. Keep the onions well cultivated and quite free from weeds. The most satisfactory results will probably be found with the transplanted onions.

Parsnip.—Sow a row now and then to keep up a supply. The ground for parsnips should be trenched about 2 feet deep.

Peas.—In the cool districts, sow a few rows occasionally during the month.

Pepper or Capsicum.—Transplant from seed-bed, or sow whenever plants are required.

Potato.—Plant now that frosts are pretty well over, but before planting drain well, dig deep, and manure heavily. Avoid scabby potatoes, and plant only those which are sound, and of a medium size to a depth of about 6 or 7 inches.

Pumpkin.—Sow a few seeds in well manured land.

Rhubarb.—Plant in land prepared as for asparagus. Sow seed to raise plants for setting out next season.

Tomato.—Sow seed whenever frosts are over, or plant out from seed-bed.

Turnip.—Sow a few rows in drills about 18 inches apart. Manure well.

Vegetable Marrow and Squashes.—Sow seed as freely as necessary, in well manured soil, if it should not naturally be rich or in good condition. It is sometimes desirable, even when a soil is rich, to apply some manure to give vegetables a start. A good, strong, healthy start is most desirable in growing vegetables. They are then far better able to withstand and resist the attacks of insects and other parasites; weak plants very easily succumb.

Flowers.

This is one of the most interesting months of the year for flowers. Numbers of various plants come into blossom and reward the labours of those who have sown seeds and planted various bulbs and roses, and all sorts of beautiful plants.

You will find your roses sending out great shoots, probably just where they should not be—up from the roots—and crossing in and amongst one another, and likely to spoil the symmetry of the plants. This a good time to remove such shoots and check exuberant growth, or rather divert the plant's efforts to branches where you desire the flowers to be produced and to keep the plants in good form.

Camellias and bouvardias may be planted, and both of them should be represented in all gardens where they are likely to grow; but they will grow almost anywhere if they have some little care. The bouvardia is one of the most useful and most beautiful of our flowering small shrubs. It is in blossom for many months of the year, provided it has sufficient moisture to live, for it will die if the soil becomes very dry. It needs good soil to grow to its greatest perfection.

If anyone desires to make a fine display in his garden towards the autumn, he should sow some seeds of the beautiful variegated-leaved amarants—*Amaranthus tricolor, Salicifolius,* and others. The seeds are very small, and, perhaps, should best be sown in pots or boxes, and the plants can be more carefully looked after until they are strong enough to be set out in the garden.

Tender annuals of all kinds may be sown or planted.

General Notes.

How to Set a Plough.

"New Chum" writes:—While agreeing with, and appreciating Mr. Peacock's observations, *re* "How to set a plough," in your July number, I differ from him as to the most effective method of yoking a four-horse team. I see four strong objections to hitching four horses abreast, and to hitch five horses so would be, I consider, barbarous.

(*a*) In the first place one of the team must walk on the ploughed ground, which is distressful to the horse and injurious to the land.

(*b*) In warm weather the two inner horses, and indeed the whole team, would be oppressed and distressingly, if not dangerously, over-heated.

(*c*) In turning in at the headlands, the horses would be likely to tread on each other and ruin their feet.

(*d*) And there necessarily must be, especially if the ground be at all rough, a great waste of horse power.

It is a well-known simple principle in statics that where any number of forces act on a body, the combined effect of those forces will not be the maximum, unless the *resultant* be equal to the sum of the forces, and this cannot be unless they act in the same straight line, or in parallel lines, and transferred; and as in this case under consideration, since the line of action of the force represented by each horse respectively must necessarily differ somewhat, both as to inclination and direction, there is therefore a dissipation of energy and a waste of horse power, added to the damage to the ploughed land, and the probable damage to the horses from the causes above referred to.

Now, on the other hand, if four horses are placed tandem—two and two—and hitched as horses in a waggon team, though lacking some of the disadvantages of "four abreast," this method is also very objectionable; for it is quite obvious that the line of action of the forces represented by the two leading horses, though similar in direction to the hinder horses, is not the same in inclination (not in the same plane), and that consequently the *resultant* is considerably less than the sum of the forces; and there is, therefore, not only a dissipation of energy, but a reprehensible waste of horse power. It is a reprehensible waste, because it shows either ignorance or wilful neglect on the part of the ploughman, and, moreover, because in this case much that is lost to the plough, comes as a heavy burden on the shoulders of the two hinder horses, distressing and annoying them and wearing out

their harness. Teams harnessed in this manner, however, may be seen any day, but I find it is not a prudent thing for a "new chum" to pretend to see them.

As multiple ploughs are every day coming more and more into general use, the question of how best to hitch a team so as to be at once practicable and scientific, *i.e.* so as to give the greatest comfort to the horses and afford the greatest facility for handling them while at the same time conserving the maximum energy as motive power, seems to me from the large interests at stake, a question of the highest, indeed of national importance and well deserving of being discussed in the Gazette. Nay more, the whole theorem of the "Parallelogram of Forces" as exemplified in ordinary operations on a farm, and the anatomy of a horse as regards his mechanism and adaptability as a motive engine, should be taught and constantly taught in every public school in rural districts. It would be much easier to understand and remember, and a hundredfold more useful and educative than much of the crude verbosity with which the rising generation of farmers are so assiduously being crammed.

To yoke a team of either three, four, or five horses so as to secure the nearest approach to the required conditions,—Take an iron bar about 2 in. x 1 in. and 12 in. long; let it be slightly crescent-shaped and fit it with a ring at one end, and a strong piece of chain 18 in. long at the other; measure off on the reverse side of this bar points dividing it in the ratio of 2 to 1, 2 to 3, and 2 to 2; let bolt holes be drilled at these distances, which in a 12 in. lever will be at 4 in., 4$\frac{4}{5}$ in., and 6 in.; then let this lever bar be fixed to the D on the head of the plough by a shackle so formed that the bar or lever when fixed on stand upright. When using three horses, adjust the shackle in the 4 in. hole, use a main whipple 5 ft. long for the two outer horses as in a single furrow plough, and hitch the bar of the centre horse to the chain at the upper end of lever, and give him as many links as will let him out abreast of the others. There will be no waste of power or wobbling here, and the upright bar, being proportionably divided and free to move round a fixed point will now act as a correct "indicator" of what each horse is doing and should do, and will also lessen any sudden jar on the horses' shoulders arising from stumps, stones, or hard ground. It at once secures the comfort of the horses and the maximum result for the energy expended. When working four horses, adjust the shackle, place the horses tandem, two and two, pass a draught rod, having a hook at one end and ring at the other, from the lower end of "indicator" between the two hinder horses, fix forward end of this rod to the hames by light chains so as to prevent it getting under foot at headlands, let the leading horses have trace harness and spreaders and ordinary plough traces, then with one common whipple-bar attached to ring of rod—start your team; the same with five horses, altering shackle in "indicator" as required. Yoked in this manner every horse has the maximum of freedom for his energies, and as the line of action of the force represented by each horse is such as to produce the nearest approach to the maximum resultant the team is at its best. They do not require any driving or steering; using a plough without handles

and four horses I can take a seat, or leave it at pleasure, the team still moving, or start the team across the paddock to the other headland a quarter mile off, without any driver; they drive themselves, for each horse is in its place and must keep it; so that, conversely to Mr. Peacock's, my conclusion is a plough team of four or more horses should always be placed tandem, but it may be sometimes necessary to work them abreast."

Macaroni Wheats.

In connection with the experiments with Macaroni Wheats at the Hawkesbury Agricultural College, Mr. J. W. James, C.E., of Blakehurst, drew the attention of the Department to the fact that on the occasion of his visit to the Mission Station, known as New Norcia, of the Benedictine Monks in Western Australia, he had seen the monks making macaroni from wheat grown on the farm attached to that station. Acting upon his suggestion the Department wrote to Bishop Salvado asking for samples of the macaroni, and also the wheats from which it was made. These have now come to hand. Seven different kinds of macaroni were sent, and all proved to be of excellent quality. Included in the parcel were samples of the wheats and the flour from which the macaroni was made. The Bishop states, he imported the macaroni-making machinery from Naples. He says, "that anybody can make macaroni, that is, what is known in Italy as 'Porto-a-mano,' without machinery; but no true hollow macaroni can be made without the proper machinery. Being fully convinced that the bread made of the finest flour is not the best nor the wholesomest as daily bread, the flour we use here for bread and macaroni making is not the finest, but as near as possibly as that known as 20 per cent. flour."

In connection with the growth of macaroni wheats it may be stated that a large area under crop at the Hawkesbury Agricultural College has made a wonderful growth. At the present time it is 3 ft. 6 in. high and a portion is being cut for green feed; the yield is very heavy and the fodder of excellent quality. It is intended to manure the crop after cutting, with the idea of obtaining a second crop for seed. The result of these trials already proves that the macaroni wheats are valuable for early crops of green fodder and should they yield a second crop, which can be cut either for seed or for hay, they will be of exceptional value.

In his Annual Report for 1898 the Wheat Experimentalist, Mr. W. Farrer, makes especial reference to the importance of testing the macaroni wheats in the coastal district, and says: "One object of experimenting with such wheats at Richmond ought, I think, to be to find out whether it is possible to grow macaroni wheats in the coastal counties, and if so, what varieties are the most suitable. I have long thought that these wheats might be grown with advantage in places near the coast where bread wheats are destroyed by rust. When I was in South Australia, about six years ago, I found that some of these wheats were being grown for hay by some of the farmers in the neighbourhood of Adelaide, and that they were liked for this purpose

(1) by the farmers who grew them, because the straw is in general much taller and more solid than that of the bread wheats, and the hay weighs well; and (2) by the consumers, because the hay which is made from these wheats is supposed to be peculiarly sweet. I was told that the beards which are carried by all the macaroni wheats were not considered very objectionable. This I can only think is the case when the hay is cut not later than when the plants are in flower. The beards would not then have had time to become hard. The unfortunate prejudice which exists in the Sydney market in favour of hay with grain in the ears, and consequently with relatively hard, woody, and innutritious straw, over that which has been cut before grain has been formed, and, in consequence, is green, soft, digestible, and more nutritious, will, I fear, prevent the merits of hay made from macaroni wheats from selling for its true value for some time. If it be found that macaroni wheats can be grown successfully in the coastal counties, they might also be grown there for the production of grain at least as profitably as bread-wheats are grown for grain in the interior; for although the flour made from these wheats is inferior for the making of bread, mainly because it is of a grey colour, it is in the whole even more nutritious than bread-wheat flour, and these wheats find a ready sale at excellent prices in France and Italy. The macaroni-making industry might then, also, be established in the Colony with the highly desirable result that we should then be able to purchase our macaroni fresh, and would enjoy it the more from knowing that it had been made under the eyes of sanitary inspectors. With the above objects in view I am purposing in the immediate future to test experimentally the growth of macaroni-wheats at the Hawkesbury Farm, and for this purpose am growing at Lambrigg some new wheats, which are the results of crosses between macaroni wheats and between these wheats and *Triticum Polonicum* (mammoth rye), seed of which I shall be able to send to Mr. Valder this autumn. I have also this summer made a few fresh crosses between these wheats for this special purpose."

Successful Treatment of Blindness in Horses in the Lower Darling Country.

For several years past horse-owners in the Lower Darling country have been troubled by an affection of the eyes of a great many of their horses. Mr. Alexander Bruce, Chief Inspector of Stock, now reports that, at last, the disease has been diagnosed as of parasite origin, and a successful means of treating it has been discovered by Mr. Stock Inspector Morgan, who has devoted great attention to the matter for a long time. From the *Wentworth Standard*, it appears that a Menindie troop-horse, Sandfly, had become totally blind at night-time, and partially by day; and, being a valuable animal, the authorities were much concerned about it. Eventually, the advice of Mr. Morgan was sought, and he prescribed the following remedy, with the result that the horse was thoroughly cured. The treatment consists of a drench to be used once a week composed of 1 pint of rich linseed oil and 2 oz. of turpentine; a vermifuge powder to be given in the horse's feed every

day, and made up of the following ingredients:—Common salt, 2 lb.; powder sulphur, 2 lb.; black antimony, 1 lb.; tartar emetic, ½ lb.; sulphate of iron, 1 lb. Dose, 1 oz. This powder should be commenced the day after the drench is administered, and should be thoroughly mixed with the feed damp. Then there is a lick of 14 lb. of salt, 1 lb. sulphate of iron, 1 lb. sulphur. This should be put in a convenient place for the horse, and the treatment should be continued for a month. As some of the ingredients named are poisonous, the Stock Inspector recommends that they should not be mixed by unskilful hands. He says the remedy can be administered to horses in a paddock as successfully as to those stabled; but care must be taken that each horse, if several are being treated, finishes his own feed, and is not allowed to get to the feed of another. Mr. Morgan says that the remedy cannot be depended on for success where the disease is of long standing; but he thinks, if taken in time, it is thoroughly effective.

In forwarding his report to the Chief Inspector, Mr. Morgan mentions that the treatment above described is similar to that successfully adopted by him in the case of a number of blind horses on the Avoca Station, in Wentworth district; and adds that this development completely upsets the theory of the blindness being occasioned by melon, or, as it was believed at one time, by wild tobacco. Both plants may be conveyances of the disease, but in the case of "Sandfly" the affliction must have been conveyed through stable feed or in some other way. Efforts are now being made to trace the origin of the feed of this horse to determine the question. There was a horse (Ratler) at Cuthero that became blind in stable, but he was only partially stabled. "Sandfly," however, has been continuously stabled for two years.

Some Reports on Guinea Grass (*Panicum maximum.*)

When roots or seeds are allowed to settlers, from the Experimental Farm at Wollongbar, Richmond River, it is usual to request the recipient to report results in course of time. Mr. Jackson, the manager, has recently received the following:—

Mr. George A. Bolton, Crystal Creek, North Arm, Tweed River, says:—"February 24th, 1899. You asked me to inform you how the Guinea grass you so kindly sent me, got on—well I am most pleased to say it has done something wonderful. It is two months exactly since I planted it, and you will hardly credit it, but it is 6 feet high, and shooting out into seeds, although half the time it was scorching weather. I made forty plants out of the twelve roots you sent me—all but one grew. I am quite delighted with it, and would be most thankful if you would be so good as to tell me where I could purchase the seeds of it, and what time they should be sown, and if they would grow shaken on old pastures."

Mr. Brentwood, South Grafton, March 1st, 1899, says:—"The Guinea-grass roots forwarded and received by me were planted on the 1st January. Mostly all took root, and now the grass is about 3 feet

high, and just started to come to seed. All who have seen it are quite satisfied that it is a first-class grass for dairying purposes. I think all dairying farmers should go in for it and the Paspalum as quickly as possible."

Mr. H. Baillie, Eden Vale, Stockyard Creek, Clarence River, 6th March, 1899, says:—"You would oblige me very much if you could tell me where I could purchase the seed of the Guinea-grass. My brother wrote to some of the principal seedsmen in Sydney, but they said it was not procurable. Perhaps you have some you would dispose of; if so, I would be glad to buy it at any reasonable price. The few plants I grew from the parcel of seed I got from you, I planted out in rows 4 feet apart, about a fortnight ago, in poor sandy soil, and they are doing splendidly, growing like mushrooms. The roots you sent me are now nearly, if not quite 8 feet high, and still growing. Of course it would not be advisable to allow it to grow so high for feeding purposes, but I am letting it grow as it likes to get all the seed from it I can. There is one peculiar feature in its growth—when the top is cut off for seed the next joint to the one cut shoots out another top with equally as good seed as the first, and so it goes on. It was about 4 feet high when it first came in seed. So far no one could wish for anything better, and if it withstands the frost it will be a great boon to this district. Of course, when I was over on the Experimental Farm in July last it was quite green, but the frosts are more severe over here. There is one thing I am quite convinced of, and that is, there is no grass I have ever seen will stand the dry weather like it, not even the *Paspalum dilatatum*, and that stands it well. During all the dry weather the Guinea-grass was quite green, and never stopped growing. I would like to get as much seed as would sow 8 or 10 acres to start with. I am saving the seed from the few stalks that I have as carefully as if it was gold-dust, for I believe it will turn out some of the yellow metal yet.

Mrs. Anne Beddoes, Dunoon, 17th June, 1897.—The Guinea-grass I planted in a damp black soil, in a well-drained place, and the grass has shown an excellent growth for the time of year. It is a grass that I am well satisfied with, and believe it would suit damp places. The frost, so far, has taken no effect on it. I have also saved seed from it.

Mr. H. M. Williams, Wollongbar, 24th July, 1899.—I planted the roots out in a newly burned paddock, mixed with Paspalum and several other grasses, on 2nd February. They did not even droop, but started to grow at once, and were very soon in seed. I allowed the seed to shed naturally, so that later on I might judge as to its grazing qualities. It is still growing although we are now in midwinter, and showing plenty of feed. There is no doubt in my own mind that it will be a great acquisition to farmers and pastoralists; the immense volume of feed it gives is surprising. It resists the drought wonderfully. It makes a good chaff, and would be a capital fodder for ensilage. I am so pleased with it, and so confident of its future usefulness, that I shall this spring lay down a paddock with it solely for the purpose of saving the seed.

RESULT of COMPETITION for a Special Prize of £5 5s. offered by the North Coast Steam Navigation Company for best Acre Winter-grown Potatoes, for culture, quality, evenness and weight; and carried out under the auspices of the Clarence Pastoral and Agricultural Society, Grafton. Judges—Messrs. T. Hadfield, J. W. Ford, H. A. Dolckeds.

Name.	Locality.	Variety.	No. drills to Acre.	Yield per acre marketable.	Small.	Total Yield.	Award.	Time land under cultivation.	—
				Tons cwt. qrs. lb.	Tons cwt. qrs. lb.	Tons cwt. qrs. lb.			
E. E. Crispin	Carr's Island..	Circular Head.	49	7 14 0 0	0 9 3 6	8 3 3 6	Fourth ..	35 years; previous crop potatoes.	Cultivation very good; crop clean and even.
A. Short......	Lower Southgate.	do ...	...	Retired.				30 years; previous crop maize.	Cultivation good; crop even, showing signs disease.
T. Hannah...	do	do ...	51	6 13 3 12	1 15 0 7	8 8 3 21	....	First crop..............	Cultivation good; crop clean, fairly even.
J. J. Duggan	Grafton	Brownell's Beauty.	59	7 16 2 24	0 13 3 14	8 10 2 10	Third ...	30 years; previous crop potatoes.	Good cultivation; crop very even.
Do	do	Circular Head.	53	10 1 0 13	0 14 1 20	10 15 2 5	1st prize, £5 5s.	1 year; previous crop potatoes.	Good cultivation; crop very even.
F. W. Paine	Clarenza	Early Vermont.	44	6 14 3 0	0 5 0 12	6 19 3 12	....	30 years; previous crop cane.	Cultivation very good; crop clean and even.
W. J. Dykes	Grafton	Circular Head.	53	8 10 0 13	0 15 2 13	9 5 2 26	2nd prize, £2 2s., by Society.	First crop..............	Cultivation good; crop even and clean.
J. Dickson ...	Carr's Creek...	do ...	48	6 6 3 12	0 12 3 12	6 19 2 24	....	30 years; previous crop potatoes.	Cultivation good; crop even and fairly clean.
T. Baker......	Alumny Creek	Brownell's Beauty.	48	5 8 0 0	0 8 2 18	5 16 2 18	....	30 years; previous crop maize.	Cultivation fair; crop even.

The Society have decided to award a Second Prize of £2 2s., and Certificates to other competitors.

JAS. O. WILCOX,
Secretary.

Dairying on the South Coast.

Following the lines suggested by this Department, reports Mr. M. A. O'Callaghan, the following factories have within the past few months erected capable pasteurising machines, and circular cream coolers:—

Berry Central Factory.	Farm Meadow Factory.
Jindyandy Factory.	Merroo Factory.
Jasper's Brush Factory.	Back Forest Factory.

The butter made from the milk and cream supplied to these places is now fetching ½d. per lb. over the top market rates in Sydney; and the farmers are benefited thereby to a very considerable amount. These factories are all situated in or near Shoalhaven district, and the last two to erect plants have been Back Forest and Berry Central. This latter is supplied with cream already pasteurised from most of these other factories; but some separating stations being too slow to adopt the system which was doing so well for the others, the Central Factory last week erected a plant for the purpose of pasteurising the cream on its arrival from those separating factories that do not possess pasteurisers. This will work all right in cool weather; but in summer the cream will arrive at the central station too sour to be benefited by pasteurising, and the work will be best done at the stations where the milk is separated, except in cases where the separating station is very closely situated to the central butter factory. I have just returned from a trip to the South Coast, where I assisted in erecting a pasteurising plant at Back Forest, but which factory must make some repairs to machinery before things will run smoothly. All the other factories are working well, and all are using the lactic ferment "starters" supplied by the Department for ripening their cream, with complete success. The financial success which has followed on our advice and instruction here, forms a strong reply to critics of Government experts.

Other parts of the Colony are also falling into line, and in time the greater part of our output should be raised in standard to the extent of at least ½d. per lb., both for home and export use. Taking our dairy cows at 400,000 for butter-making, yielding, say, 100 lb. butter, or 250 gallons of milk per year, ½d. per lb. on the product would amount to over £83,000! These 400,000 cows, instead of yielding 100 lb. of butter, should, with selection and breeding, be made to yield at least 150 lb., which should be the lowest standard for a paying dairy cow. This increase of yield, at the rate of 9d. per lb. for butter, would amount to £750,000 per year, and this is what we must aim at if we are to bring our dairying operations in a line with those of European countries. People criticised the Government for importing bulls; but they do not consider the amount of money lost annually by the inferiority of many of our dairy cattle. A few of the older dairying districts have good-yielding cows, but what of the general bulk of our farmers?

Dairy Students on Tour.—After holding the half-yearly examination for dairying students, a number of them desired to see the factories and cattle on the South Coast, for the purpose of further improving their knowledge of these items. These have been inspecting

herds and factories on the South Coast during the past week under the guidance of Mr. Cassidy; and for two days I took them in hand, and showed them over some Shoalhaven herds, pointing out to them the various breeds and crosses, and the good and bad animals. This system of education by comparison is a very good one, and remains in the mind of the student long after other lessons are forgotten.

Propagating Orange Trees.

In the *Sydney Morning Herald*, July 12th, there appeared a paragraph with respect to some oranges exhibited by Mr. W. H. Crane, of Castle Hill. The fruit was of magnificent quality, from 4-year old trees worked from trees obtained some fifty years ago from a Mr. Mortimer, who half a century since had a nursery in George-street, Parramatta, next to where the King's School originally stood. Mr. Mortimer was noted for his orange trees, and his method of reproduction was by means of layers. "They had not arrived at the lemon-stock grafting business in those days," remarks an old resident in his reminiscences of Parramatta, "and I believe the oranges were better flavoured in consequence." Many of the growers have always inclined to the belief that the orange does not do well on its own roots; but as time goes on there are many instances cropping up that go to upset this idea; and, without doubt, some of the finest oranges grown in the district (Parramatta) to-day are from seedling trees or layers over 50 years of age.

Mr. W. J. Stenning, of Randwick, asks why it is that trees worked from parents 50 years old should be better than stock obtained from trees say 5 or 10 years old. He also asks for information as to the methods of layering, which, so far as the orange and lemon is concerned, is, no doubt, new to a good many of the latter day growers.

The Fruit Expert, Mr. W. J. Allen, explains that the age of the tree from which buds or scions are taken does not affect the quality of the fruit of the worked tree so long as the tree from which the buds or scions are taken is old enough to have borne good crops of good fruit. Wood from trees which have not proved themselves to be really first-class should never be worked.

The layering of oranges and lemons is quite simple, but of necessity is rather a slow way of procuring trees by the hundreds or thousands; therefore, of late years seedling oranges have been grown, and the orange or lemon budded or grafted thereon.

The layers of many varieties will not bear any sooner than budded trees; but a layer of a seedling orange will begin to bear a year or perhaps two years before a seedling.

Citrus fruits grow readily from cuttings or layers. The lower branches of these may be staked into the ground, cut diagonally across about three parts through and covered up with earth, when they will readily strike. Some cut the roots on one side of the tree, then pull it over, slit the branches and pile earth over them; in this way starting twenty or thirty trees from the one. Such a method is not, however, advisable unless the tree has to be destroyed.

How to make a Cement Tank.

In building cement water-tanks, it is preferable to make them either square or oblong, for convenience in constructing the frame in which to mould the cement. For the foundation, dig down until solid soil is reached, or below any danger of frost, and then fill this excavation with small stones up to within 7 inches of the top, or if the bottom of the tank is wanted above the level of the ground it can be filled up as much as 3 or 4 inches more. After this is done, put on 5 inches of concrete, which is made of 6 parts of clean gravel and 1 part of Portland cement, just damp enough to firmly pack. This is a part of the work to be very particular about, as the firmer you pack it the better the job will be when finished. As soon as the concrete is put down, and before it dries any, put on a top coat 1 inch thick, which is made of 2 parts sharp, clean sand and 1 part cement, thoroughly mixed, and just wet enough to be like common mortar. The side walls should be at least 12 inches thick—10 inches of the concrete and an inch of the finishing coat on the inside and outside. A wall of less width than this is apt to spring if the tank is very large. The walls must be built inside of a frame, and as soon as the wall begins to dry the frame can be removed. In building the wall the frame can be put up as the wall is built. After the frame is started, take some of the finishing coat and put an inch thick on the frame, so that when the frame is removed it will make both the inside and outside of the tank smooth. After plastering up 6 or 8 inches in this manner, fill in the centre with concrete and firmly pack it. These operations can be continued to any height desired. The boards should be planed, to prevent the cement sticking when the frame is removed. A tank any size or shape can be built in this manner, and it will stand the test if care is taken in building. It is not practical to build a frame and then lath it and plaster with cement, for it is not only hard to make the cement stick, but in a short time the wood will decay and the work is lost.—M. C. Thomas, Ohio.

Tomatoes and Celery.

Mr. Joseph Richards, who has charge of the garden at Neotsfield, sends the following notes, which will be of interest to many readers of the *Gazette*:—

Late tomatoes.—There are many people who object to buy tomatoes when out of season; and the flavour is certainly not so good, especially if used as a salad, as it is in summer. Nevertheless, your correspondent, Mr. Patterson, is on the right track by trying to lengthen the season; and if he succeeds in keeping old plants in good health through the winter, no doubt he will have a very early crop. In August, fifteen years ago, I exhibited tomatoes in a collection of vegetables in Sydney, and have ever since grown late crops. I have tried old plants and cuttings, but prefer strong young plants. This

season I commenced to pick fruit on the 6th of December, and have not been without ripe fruit since (date of letter 20th July). The weather here has been exceptionally cloudy of late, consequently they are ripening very slowly at present. I generally make three sowings, and instead of forcing young plants in the early spring, a sowing is made in April. When large enough, they are pricked off into boxes, or put into pots, and placed in their winter quarters. Plants so treated are very hardy when planted out. The second sowing is made in September, and the third in January. The early and late plants I prune once a week, which I consider a most essential point in cultivation. As quantity has to be considered in summer, I do not prune much, except to stop them at the second joint beyond the third flower.

I fancy that many cottagers would grow tomatoes if they could obtain young plants early in the season. A simple method of forcing in the spring is to place a box containing a few seeds over a vessel of hot water—half a kerosene tin would answer the purpose well. The water should be renewed once or twice daily, and the box protected from rain.

Celery grown on the flat.—Last year a note in the *Gazette* recommended this method of growing celery. Just to test the system, I put out 120 plants in five rows; varieties, Cole's Crystal White and Sutton's Early Gem. The ground was heavily manured, and dug 15 inches deep; drills 3 inches deep were made for all the plants to facilitate watering. I put 18 inches between the rows for Cole's Crystal White, and 15 inches for Sutton's Gem, with 10 inches apart in the rows. The bed was then mulched with stable litter. Although the summer was such a dry one, the plants grew well; and now my trouble began. How to take the suckers off and not damage the plants rather puzzled me, and it proved a very tiresome job; and as for bleaching, it was a total failure. Sutton's Early Gem is a splendid variety, and did fairly well by tying up with flax; but it was necessary to exclude light entirely from Cole's White. This was accomplished by tying up and hilling with litter. I find nothing in the method to recommend it for general cultivation. I planted some in trenches at the same time, which was ready for use three weeks before those on the flat.

Treatment of Snake-bite.

The following directions for the immediate treatment of persons suffering from Snake-bite are published for general information by Dr. J. Ashburton Thompson, Chief Medical Officer of the Government Health Department, New South Wales.

Directions.

A ligature—that is, a strong string, tape, narrow strip of clothing, or handkerchief—should be tied at once round the limb *above* the bitten part. When it has been tied, pass a piece of stick under it, and twist it round and round so as to screw up the ligature as tightly as you

can. Leave the stick in the twisted ligature, and secure the end by another string as shown in the Figure (1). Great pain and swelling are caused by this, but cannot be avoided.

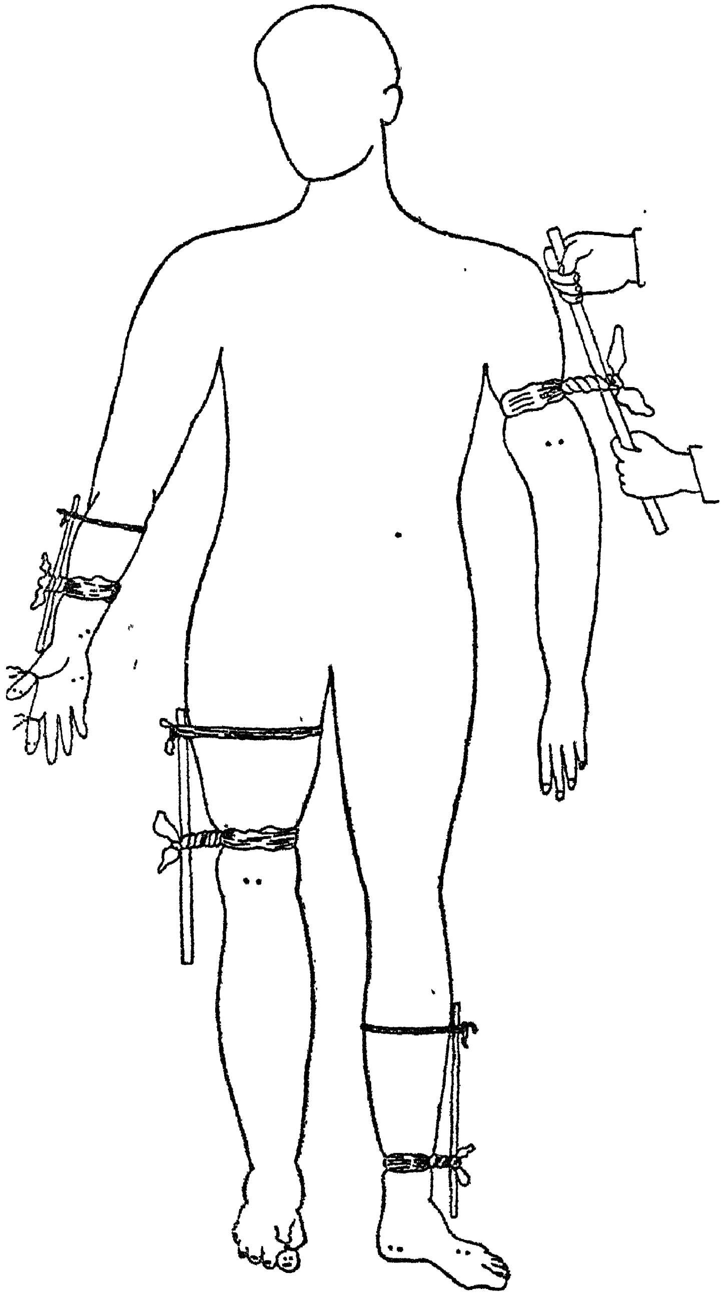


Fig. 1. Diagram showing method of applying ligatures.

At the end of half an hour undo the ligature for five minutes; then tie and screw up again. At the end of another half-hour the ligature may be removed altogether.

In places where a ligature cannot be tied, as on the neck or face, pinch up the bitten part between the finger and thumb, and cut it out (Figure 2).

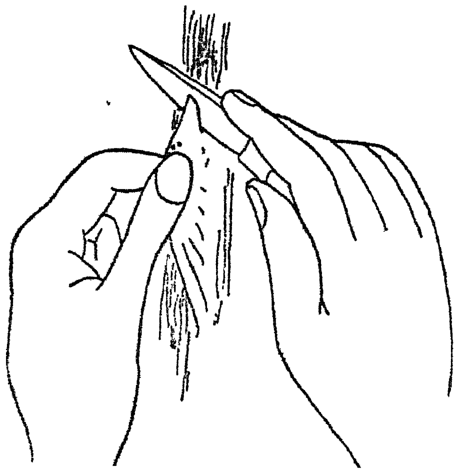


Fig. 2. Diagram showing method of cutting out bitten part.

In any case the bitten part should be cut into by numerous little cuts over and around the bites, for about half an inch around, and sucked by the mouth freely and perseveringly; and this can be done without danger by any person.

Stimulants, such as brandy, whisky, gin, rum, in small quantities at a time (a few teaspoonfuls), or strong tea or coffee, or wine, may be given if the patient be faint.

Do no more to the patient than is advised above, but obtain the services of a medical man.

The following extract from an exchange may be of interest, but that is all:—"Dr. F. E. Brown, in a late issue of the *Leesburg Commercial* (U.S.A.), gives a cure for the bite of rattlesnakes, which he says he had used successfully in his practice. We reproduce in full his letter, which may at some time prove of value to some of our readers:—Seeing in your paper a notice of the death of a lady from the effect of the bite of a rattlesnake, it occurred to me that it would be the proper thing to do to give you my experience with the tincture of iodine in these cases. I have treated thirteen cases of snake-bites in my practice with simply marvellous results—even restoring to life and health when the patient was supposed to be dying. My first case occurred many years ago. A little child, say three or four years old, was brought to me with two ugly gashes on the instep by a fair-sized rattler. I suppose I saw the child about an hour after the bite, with limbs badly swollen and in great pain. I applied iodine to the wound, and gave the child drop doses every ten minutes for an hour, then every half-hour until decided improvement. The child took 10 to 15 drops in all. Next morning the father reported child perfectly recovered and playing around as usual. My last case was about one year ago. A lad about fifteen

years old, whilst reaching under some boards for hen-eggs, was bitten on his right hand by a large rattler. He was brought to me with hand and arm enormously swollen, and scarcely able to stand on his feet. I pursued precisely the same treatment as in my first case, except that I doubled the dose. He took in all perhaps 25 drops of the iodine. He recovered rapidly, with no outward results. Some of my cases were much more remarkable than these; each one recovering quickly, with no suppuration of the wounds or other outward results. It is equally efficacious in the treatment of dumb beasts. A neighbour of mine had a cow bitten, which when found was unable to stand. I supplied the owner with iodine, and advised him to go back and drop 10 drops upon her tongue every ten minutes for an hour, then every hour for a time. He did so, but came back in an hour or so and reported that it was too late, as the cow was nearly dead. In the morning he went back to see what had become of his cow, and to his surprise found her up and feeding. Her recovery was rapid."

A Handy Hotbed.

A hotbed is a most useful appliance in a garden, no matter how small, and can be made with very little trouble or expense. Its uses are manifold. The season can be lengthened at either end by its aid. Cabbage, cauliflower, Brussels sprouts, and scores of other plants can be obtained several weeks earlier than by planting even in sheltered beds; while tender plants, such as tomatoes, egg-plants, cucumbers, and melons, can be well advanced in the hotbed by the time it would be safe to sow the seed in the open.

The requisites are a packing-case and a glazed sash to fit it. First look out for your sash. Perhaps you have or can beg or borrow or —— (buy) an old one; if not, one can be obtained from the stores for a few shillings. Then get your packing case to fit it, so that the outside rim of the sash will lie on the edge of the case, which will possibly have to be altered to fit; and if, while you are altering it, you can level the top so that one end of the sash will be nearer the ground than the other by 2 or 3 inches, or perhaps a little more, so much the better. You will not want any bottom, and sides should not be more than 12 to 15 inches high. When this is prepared, choose the site for the bed—out of the wind if possible. If with a gentle slope, so much the better; if not, it will not matter. Dig a trench 3 feet longer than the long way of the sash, 1 foot deep, and the same width. In the bottom of this dig a smaller trench, 6 inches deep and wide. If on a slope the higher end will be the chimney end, and the lower fireplace; if on level ground, fireplace end should be a bit deeper and a drain run out from it to take away any water that soaks through. If you have drain-pipes of any sort, you can lay them in this trench for a flue; if not, put bricks or flat stones along to make flue, then fill in dirt again. Chimney, about 6 feet high, can be made of boards if nothing else is available. Mine is made of sawn hardwood palings, but it is 14 feet from the fire, so that the smoke gets time to cool. Drain pipes would make a good

chimney if obtainable. The fire end should be enlarged to make room for a fair-sized log. Place the box on the top of the flue, letting it down into the soil about 5 or 6 inches. All the inside soil can be taken out and banked round the outside. Fill the inside with 5 or 6 inches of rich mould, or a mixture of jadoo and sandy loam. Light up the fire and you will after a while be able to feel a gentle warmth under the glass. And, by-the-bye, if you cannot get glass make a batten frame, cover both sides with calico, and give it a coat of oil. It will answer as well in warm localities and nearly as well in others.—HERBERT J. RUMSEY, Boronia, Barber's Creek, N.S.W.

HEAVY YIELD OF HONEY IN VICTORIA.

MR. J. L. THOMPSON, Travelling Instructor in Agriculture, has received from Mr. Edward Fraser, of the Working Men's College, Horsham, Victoria, the following communication with respect to an exceptionally heavy yield of honey at one of the principal Victorian apiaries last season:—

"The editor of the *Times* has handed me your letter of the 28th ultimo to reply to, *re* the extraordinary yield of honey in this district. I do not know if you are aware that a statement appeared that a Mr. Russell obtained about 70 tons from 300 colonies, and that he contradicted the statement. As he is the largest apiarist here, and the last season being a good one, I give you herewith the facts as he informed me:—

"He has about 300 colonies of bees, and during last season obtained from 27 to 28 tons of honey from them.

"Every other year is a good one in this district, the flow of honey being dependent on the flowering of the eucalyptus trees, yellow Jack, blue-gum, chiefly, also plenty red-gum.

"He had one hive that yielded 660 lb., and a number of others equally strong, but no record kept of them (about one-fourth of his apiary are Italians; this is my own surmise; I did not ask him the number; I think he prefers them); but as he takes a deep interest in anything pertaining to the apiary, I am sure he will be pleased to answer you any questions. His address is—H. Russell, 'Wartook Apiary,' *via* Horsham, Victoria.

"The trouble with honey here is to find a profitable market for it. It sells at 2¼d. to 2½d. in Melbourne in auction rooms, deducting freights, &c. This is hardly a payable price for it for those removed distantly from market. A great deal was sent to London, but results very unsatisfactory—bad packing, leakage, ungraded, no buyers, prejudice, flavour (supposed to be of the eucalyptus), local interests, &c., all operating against sales.—Yours faithfully, EDWARD FRASER."

In connection with this correspondence, it may be of interest to mention that the record yield of honey in New South Wales, according to the *Western Post*, was obtained by Mr. H. Peterson, of Wattle Flat, who sold 21½ tons in 1891–2 from sixty-four colonies, spring count, and 22½ tons the following season. Mr. Peterson states that

he had five or six colonies that produced over 1,000 lb. of honey during the season, and two that gave 1,250 and 1,120 lb. respectively. Some of the hives gave 80 and 90 lb. per week during a long season. Mr. Carroll, of Dresden, Texas, U.S.A., is said to hold the record for honey-production in America, who obtained 1,000 lb. of honey from one colony of Cyprian bees. Every farmer in the Colony should keep bees to utilise the bee-food in his district, and increase his income. "Many littles make a mickle."

				£
In 1894	New South Wales	produced	honey valued at	15,500
,,	Victoria	,,	,,	12,500
,,	Queensland	,,	,,	7,500
,,	South Australia	,,	,,	8,000
,,	West Australia	,,	,,	1,200
,,	Tasmania	,,	,,	3,000
,,	New Zealand	,,	,,	10,000
	Total for Australasia	...	...	£57,700

The Carpet Grass of the Southern United States (*Paspalum compressum*).

Correction.

In connection with Mr. Maiden's article on the above grass, page 726, vol. X, part 8, a plate entitled *Paspalum compressum*, but depicting another grass altogether, *Agrostis Muelleri*, was published in error. As mentioned in his article, page 727, it is Mr. Maiden's intention to illustrate the carpet grass as soon as good specimens are available.

Replies to Correspondents.

Manurial Value of Spent Tan-bark.

In answer to a correspondent, who asks for information as to the manurial value of spent tan-bark, and whether it would be good to use on land to be planted with lucerne, the Chemist, Mr. F. B. Guthrie, reports:—Spent tan-bark has a very low value as a plant food. Its most useful application is in the form of a mulch for fruit-trees or strawberries, or in the compost-heap. It may be utilised with advantage in improving the texture of the soil in heavy soils, or in land poor in humus. On an average this material contains about—nitrogen equal to 0·16 per cent., potash equal to 0·08 per cent., and phosphoric acid equal to 0·04 per cent.

Treatment of Citrus Orchards.

Mr. W. W. King, of Arcadia, has submitted the following queries, to which the replies of Mr. W. J. Allen, Fruit Expert, are now appended:—

1. *Pruning of citrus trees, especially lemons.*

To secure the finest lemons the tree should not be allowed to run up too high, as generally speaking the lemon throws out long weak branches, which, during windy weather, are blown around, and the fruit is in consequence damaged considerably; therefore a low, rather spreading tree, well sheltered from the winds, is the best, and it is always found that the best fruits on the tree are those which are sheltered inside the tree, and on all the inside lower branches, where the fruit is well shaped and thin skinned.

The orange tree usually has its head started in the nursery from 20 to 30 inches high, but this is of little use, as when the trees are removed from the nursery and taken to where they are to be planted out in orchard form, most, if not the whole, of the top is removed so as to enable the tree to recover more quickly from the shock it receives in having its roots cut. After planting, it is always advisable to shade the stem until the branches start growing at the top and leaves on the stem, neither of which should be removed for a while. I have found it advisable in this country to allow everything to grow the first year after planting. The second year, take off the bottom shoots as high up as from 1 foot to 15 inches from the ground, and the third year form your tree by starting the head or crown about 24 inches from the ground. Even now very little pruning is required, as the larger the top the more vigorous the root system will be, and better able to start the tree out quickly when pruned.

It is never advisable to prune a citrus tree during the winter, as it exposes it to the cold winds, and sometimes frosts, both of which are very injurious to its growth and tend to stunt it. Always try to

prune just before a growth, and if any rough cuts are made, trim them off smoothly with the chisel, and paint them with rubber paint or shellac and alcohol, mixed to form a paint, and apply with a brush.

When once we have got a well-balanced orange tree, with branches evenly distributed around it, and it has started to bear, it is advisable to clean out any rubbish or small branches in the centre of the tree, so that the air may get in and have a free circulation. It is then more easy to keep it free from scale, and when necessary to spray the work can be done more effectually by enabling the person to get at the inside. If possible, prune just before the first growth in the spring. When the tree has attained a fair size—say about the fourth year—any laterals projecting out on the sides or top may be cut off, so as to keep the tree evenly balanced and fairly compact. The fruit buds always come on the new growth, and, by keeping the tree in a healthy growing condition by an occasional dressing of stable or sheep manure, it will ensure a fairly good crop of fruit every year.

2. *As to what ultimate effect removal of shelter timber has on a citrus orchard, and whether the cost of artificial break-winds would be repaid in additional productiveness and improved quality of fruit?*

Citrus orchards which are exposed to high winds usually have a stunted appearance, the trees growing better on the lee side than on the side where the prevailing winds strike them. Many of the leaves are blown off by the heavy winds; the fruit is blown about, and from exposure it becomes rough, thick-skinned, and either thorn-pricked or marked by being blown against the branches. On the other hand, a well-sheltered orchard does better in every way. The trees make a better growth; consequently they are healthier and produce fruit of better quality and appearance, and I am decidedly of opinion that it always pays to plant good break-winds when the orchard is not naturally sheltered; indeed I have seen citrus orchards in California where every 5 acres had a break-wind surrounding it—that was, in exposed places.

3. *Is it not a fact that the working of trees by means of buds, &c., from young trees, say 4 to 6 years old, will be practically useless?*

Trees may be worked from other trees of any age, so long as the trees from which the buds are taken are healthy and bearing good crops of good fruit. Buds should never be taken from trees which have not proved good bearers of good quality fruit.

4. *Some lemons have narrow leaves and grow more scraggy in appearance as they age (commonly called duffers). Is it better to grub them out or to work them afresh?*

I would recommend replanting when poor lemon trees are discovered in the orchard.

5. *Do Washington Navel orange trees grow a fair size, or are they inclined to be dirty always and make bad-shaped trees?*

When grown under favourable conditions, the Washington Navel makes a fair-sized symmetrical tree. The branches are inclined to droop; but, if kept properly pruned, they are a very pretty tree.

Cultivation of Persimmons.

Mr. King also asks for information concerning the cultivation of persimmons, and in answer Mr. Allen says:—Persimmons usually do best on any of our light well-drained soils, but in many places they are found doing very well in rather heavy clay lands; but in our coastal districts the former soil appears to be the home of the persimmon, and I have never seen, either in Australia or America, better persimmons than those grown on the coast of New South Wales. To give best results the land should be liberally supplied with potash, as also commercial fertilizers rich in phosphoric acid. These trees require the same thorough cultivation as other fruit-trees. They are a deeply-rooted tree having tap roots, therefore the plough and cultivator can be used to advantage. They are propagated by raising seedlings, then budding or grafting same as all other fruit-trees. The following are good varieties:—Diospyros Kaki, Hachiya, Hiyakume, Yemon, Zenji. The tree does not require very much pruning—merely removing dead wood and any cross limbs which interfere with others, keeping the leading branches cut back so that the tree is evenly balanced. If the tree makes strong growth at each pruning, cut away about half, keeping the tree rather low. When trees overbear they should be thinned, so that better-sized fruits may be obtained, also to prevent the heavy crop weakening the tree, which will enable it to produce regular crops from year to year, instead of having a heavy crop of inferior fruit one year and a light crop the alternate year.

Stocks for Budding or Grafting.

In reply to inquiries as to the best kinds of stocks to use for the budding or grafting of fruit-trees, the Fruit Expert, Mr. W. J. Allen, furnishes the following list:—

Peach, Plum (Japanese), Apple, and Pear trees, and Muscat Hamburg cuttings—

Peach should be worked on seedling peach.

Plum (Japanese) should be worked on seedling peach for most varieties. Myrabolan Plum also makes a good stock.

Apples should be worked on Northern Spy stock, which is blight-proof.

Pears should be worked on pear stock for standard varieties.

Pears should be worked on quince stock for dwarf varieties.

Apples should be worked on Paradise stock for dwarf varieties.

Muscat Hamburg grape cuttings on any strong growing vine, but where procurable all vines should be worked on blight or phylloxera-resistant stock, so as to avoid the phylloxera, which is quite as destructive to a vine as woolly aphis is to an apple-tree. Therefore avoid working either vines or apples on stocks which are not blight-resistant.

Fowl Lice.

The Entomologist, Mr. Froggatt, has furnished the following answers to a series of questions submitted by Mr. W. S. Denning, of Randwick, with respect to fowl lice.

History of their origin, and how they originate on a new farm, cleaned once a week.

All varieties of fowl lice come from eggs laid, as a rule, on the fluffy feathers of the birds, and are carried from one place to another either in egg form or as mature insects on the bodies of fowls or birds that have become infested in dirty yards or fowlhouses. They will live for a year, or longer, in a suitable situation, feeding on the blood of the fowls they infest; but they can also exist a long time in dirt and nooks and crannies, on the look-out for a friendly fowl.

The use of such parasites is not known to the entomologist. The best way to destroy the lice and their eggs is to keep the fowlhouse clean, spraying or washing it well with hot water, or water with a little kerosene or carbolic added. Afterwards whitewash the inside thoroughly, and strew with lime at frequent intervals. They will infest fowls all the year round in suitable quarters. They will not live on a human being more than a day, and cannot live in his clothing, being an altogether distinct species and of different habits to those loathsome vermin that affect man.

The eggs are laid on the feathers, and when the lice are hatched out they attach themselves to the skin to feed, but do not remain a fixture like ticks.

The best preventive measures to adopt are to keep the fowls in perfect health and to maintain absolute cleanliness in the yards and houses. Provide plenty of dust or ashes for the fowls to bath themselves in; and when new poultry from strange places are introduced, quarantine them for a week or two in a pen plentifully sprinkled with lime. But, as a rule, it is found that nearly all fowls, however carefully they are tended, will have an odd parasite occasionally.

Characteristics of Honey.

Mr. W. Hessel Hall, M.A., of Lapstone Apiary, Emu Plains, suggests that articles on the classification and characteristics of the main types of honey in the Colony would be interesting to many. It is a pity, he thinks, to lose the distinctive flavours and odours as will be done if mixed consignments are all warmed up together in preparation for export.

Mr. Albert Gale, in respect to this point, says our honey-producing flora are so various, and, at the same time, so irregular in blooming, that to keep up a regular supply of honey of any one colour, aroma, or flavour, so as to make regular shipments of honey having any one of such characteristics would be inexpedient, hence the necessity of grading and bulking by the Board for Exports. Notably is this the case with our coastal honeys.

To write articles on "the colour, aroma, flavour, and general characteristics of honey" so as to convey in words the effect on the senses of another person, or to describe the impression on the eyes, nose, or tongue, a honey has produced on oneself, would not, in all probability, convey that sensation to any one else, and, taking all things into consideration, Mr. Gale says it is a matter he would not like to undertake.

Hard-shell Duck Eggs.

Mr. C. W. R. Parker, of Durren Durren, asks for information as to why the shells of duck eggs in the incubator get like stone just before the young ducks hatch. He has found some so hard that the young birds could not break their way out.

The poultry expert, Mr. J. J. McCue, says duck or hen eggs get no harder in an incubator than under the hen. The eggs sound more like crockery in an incubator, for the reason that they do not get that smooth, slightly oily appearance that the sitting hen gives them. Very often it is the white skin under the shell that is tough, and, consequently, makes it difficult for the chick or duckling to get out. This can often be remedied by moisture.

Duck Farming.

In answer to inquiries as to the best way in which to make a start in duck farming, Mr. J. J. McCue, Poultry Expert at the Hawkesbury Agricultural College, says: "To be successful in duck farming, you must commence with good breeding birds; the Pekin or Aylesbury, if of a good laying strain, being the two best varieties.

"Breeding ducks require very little housing, and duck-pens can be erected very cheap, for 2 feet wide wire-netting will keep them in. To rear ducks in numbers, you should use incubators and foster-mothers, and give careful attention to the feeding and housing of the ducklings till at least four or five weeks old. After that age they will do in open pens till ready for market. I am preparing a paper on 'Duck Rearing, Housing, and Feeding,' which will appear in *Gazette* shortly."

The Life-history of the Pumpkin Beetle.

In answer to inquiries by Mr. J. R. Hughes of Cumnock, the Entomologist, Mr. W. W. Froggatt, says the life-history of the little black and yellow beetle, which sometimes swarms in pumpkin and melon vines, and is scientifically known as *Aulacophora hilaris*, has never been worked out. It is probable that the insects in the grub stage live underground, and pupate there. An insectarium has just been built at the Hawkesbury Agricultural College, and Mr. Froggatt intends to study this beetle from the egg throughout its various stages, in order to determine whether any more effective means than dusting the plants with ashes or lime or spraying with Paris green can be devised for coping with this pest.

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society	A.B. Chippindall	Jan. 11, 12
Lismore A. and I. Society	T. W. Hewitt...	,, 18, 19
Gosford A. and H. Association	W. McIntyre ...	,, 20, 21
Kiama Agricultural Association	J. Somerville ...	,, 25, 26
Wollongong Agricultural Association	J. A. Beatson ...	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery ...	,, 7, 8
Manning River A. and H. Association	W. Plummer ...	,, 9, 10
Liverpool Agricultural Society	J. E. Wilson and G. L. Sutton, Hon. Secs.	,, 9, 10, 11
Berrigan Autumn Show	R. Drummond...	,, 15
Ulladulla A. and H. Association	C. A. Cork ...	,, 15, 16
Lithgow A. H. and P. Society	M. Asher ...	,, 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society	E. H. Sargent...	,, 17, 18
Tumut A. and P. Association	M. McNamara ..	,, 22, 23
Alstonville A. Society	N. R. Elvery ...	,, 22, 23
Port Macquarie and Hastings A. and H. Society ...	J. Y. Butler ...	,, 23, 24
Bega A., P., and I. Society	John Underhill..	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes) ...	John Priest ...	,, 1, 2
Robertson Agricultural and Horticultural Society ...	R. G. Ferguson	,, 2, 3
Upper Murray (Tumbarumba) P. and A. Society ...	W. Willans ...	,, 7, 8
Tenterfield Intercolonial P., A., and M. Society ...	T. W. Hoskin...	,, 7, 8, 9, 10
Cudal A. and P. Society	C. Schramme ...	,, 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood.....	,, 8, 9
Oberon A. H. and P. Assoc.	Alfred Gale ...	,, 9, 10
Berrima District (Moss Vale) A., H., and I. Society ...	H. Richardson...	,, 9, 10, 11
Castle Hill and District A. and H. Association... ...	F. H. Rogers ...	,, 10, 11
Cobargo A., P., and H. Society	T. Kennelly ...	,, 14, 15
Southern New England P. and A. Association (Uralla)..	P. M. O'Connor.	,, 14, 15
Inverell P. and A. Association	John McGregor	,, 15, 16, 17
Nepean District (Penrith) A., H., and I. Society ...	E. K. Waldron..	,, 16, 17
Gundagai P. and A. Society	A. Elworthy ...	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts ...	,, 16, 17
Candelo Agricultural Association	C. H. Brooks ...	,, 16, 17
Cumnock P. A. and H. Assoc.	W. L. Ross ...	,, 17, 18
Walcha P. and A. Association	F. Townshend...	,, 21, 22
Blayney A. and P. Association	H. Woolley ...	,, 22, 23
Upper Hunter (Muswellbrook) Agricultural Society ...	J. C. Luscombe	,, 22, 23, 24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Bangalow A. and I. Society	John R. Wilson	,, 23, 24
Crookwell P. and A. Association	M. P. Levy ...	,, 23, 24
Warialda P. and A. Association	W. B. Geddes...	April 5, 6
Gulgong A. and P. Assoc.	C. E. Wilton ...	,, 7, 8
Mudgee Agricultural Society	J. M. Cox ...	,, 11, 12, 13
Cooma P. and A. Assoc.	C. J. Walmsley	,, 12, 13
Clarence P. and A. Association	Jas. C. Wilcox..	,, 13, 14
Lower Clarence Agricultural Society (Maclean)... ...	G. Davis ...	,, 18, 19
Richmond River (Casino) A., H., and P. Society ...	Jas. Tandy ...	,, 19, 20
Hunter River A. and H. Association	W. C. Quinton..	,, 19, 20, 21

Society.	Secretary.	Date.
Orange A. and P. Association	W. Tanner, jun.	April 26, 27, 28
Wellington P. and A. Soc.	R. Porter ...	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	....	,, 4, 5
Coonamble P. and A. Association...	F. C. Lamotte...	,, 10, 11
Dubbo P. A. and H. Assoc.	H. Munckton ...	,, 9, 10
Hawkesbury District A. Assoc. (Richmond)	C. S. Guest ...	,, 11, 12, 13*
Mudgee Agricultural Society	J. M. Cox ...	,, 16, 17
Walgett P. and A. Assoc.	Thos. Clarke ...	,, 17, 18
Durham A. and H. Assoc.	C. E. Grant ...	,, 17, 18
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20
Moree P. and A. Society	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Assoc.	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association	N. A. Read ...	,, 1, 2
Parkes A. and H. Association	J. H. Lane ..	,, 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Soc.	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
Moree P. and A. Society	S. L. Cohen	,, 30, 31 September 1
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Moama A. and P. Association	C. L. Blair ...	,, 13
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Germanton P. A. and H. Society	G. T. S. Wilson	,, 20, 21
Yass P. and A. Association...	W. Jermyn ...	,, 21, 22
Temora P., A., H. and I. Assoc.	W. H. Tubman	,, 27, 28
Burrowa P. A. and H. Association	F. H. Tout ...	,, 28, 29
Queanbeyan P. and A. Association	A. W. Moriarty	,, 28, 29
Holt-Sutherland H. and P. Society (Miranda)	E. Thacker ...	October 2
Berry A. Association	A. J. Colley ...	Dec., 6, 7, 8

1900.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan., 10, 11
Wollongong Agricultural Association	J. A. Beatson	,, 31, Feb., 1, 2
Alstonville Agricultural Society	N. R. Elvery ...	,, 14, 15
Robertson A. and H. Society	R. J. Ferguson ...	,, 29, Mar. 1
Tenterfield I. P. A. and M. Society, Show	T. W. Hoskin ...	Mar., 6, 7, 8
,, ,, Fair days	,, ...	,, 9, 10
Lismore A. and I. Society	T. W. Hewitt ...	,, 7, 8
Nepean District A., H., and I. Society	E. K. Waldron...	,, 14, 15, 16
Crookwell P. and A. Association...	J. W. P. Levy ...	,, 22, 23
Upper Hunter (Muswellbrook) P. and A. Association ..	J. C. Luscombe..	,, 28, 29, 30
Castle Hill and District A. and H. Association... ...	F. H. G. Rogers	April 4, 5
Warialda P. and A. Association	W. B. Geddes ...	,, 4, 5

* Entries close 20th April.

[18 plates.

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Mount Kosciusko.

A Second Contribution towards a Flora of Mount Kosciusko.

J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens, Sydney.

I.—Introductory.

My former paper* contains some notes on the topography of the country from Jindabyne to Mt. Kosciusko, to which I beg to refer my readers. In a footnote to the first page of this paper occur the words: "Mr. Ingleby informed me that he believed that this (7,328 feet) will be found to be below the real height" (of Mt. Kosciusko).† He informs me that I misunderstood him as regards the mountain in question; he was referring to Ram's Head and other peaks.

My trip in January, 1898, was but a brief reconnoitre; on the present occasion our party remained ten days on the mountain. I thus was in a position to complete or confirm a number of observations made last year, and feel that we fairly well explored, from a botanical point of view, the country higher than the tree-line. We were in the position of being able to extend our visit a little longer, but felt that, for this season at least, a longer stay would not be justified by results.

II.—Tourist Routes.

Last year I ascended Mt. Kosciusko *via* Wilson's Valley and Pretty Point, and descended *via* Boggy Plain by a short cut into the Crackenback‡ (Thredbo) Valley. This year we went by the Thredbo track, with the Ram's Head Range on our right, while on the descent we took the track *via* Pretty Point and Wilson's Valley.

* "A Contribution towards a Flora of Mt. Kosciusko." (*Agricultural Gazette*, July, 1898.)

† The following heights, ascertained by Clarke (*Southern Gold-fields*, p. 130), are interesting:—Mt. Kosciusco (Mueller's Peak is meant), 7,308 feet; second height on the Muniong, 7,064 feet; Ram's Head, 6,838 feet; but, as Clarke judiciously remarks, he doubts whether his instruments or those used by Mueller were scientifically accurate, or whether, indeed, the necessary appliances for correctly ascertaining lofty heights were in this Colony in their time (1851, 1855). These heights were determined by Mr. Clarke in Jan., 1852, or Dec., 1851, and published at p. 153 of Mueller's paper in *Trans. Phil. Inst. Vict.*, ii, 153.

‡ "The origin of this name, I was told by the aborigines who speak English, to be the steepness of the ranges, to ascend which would *crack a man's back*; I do not know the authority for writing the word 'Krackenbang.'" (Clarke, *Southern Gold-fields*, p. 132.)

To those who are free to choose their route I would unhesitatingly recommend that the Thredbo route be chosen for the ascent and the Pretty Point-Wilson's Valley route for the descent. Of course the other routes are pretty, but as most people will be content with a single visit to Mt. Kosciusko, I desire to point out what is undoubtedly best.

By the Thredbo route one starts *via* Jindabyne west for the Little Thredbo, and then follows up the valley of the Thredbo for several miles. As one ascends the valley the Ram's Head Range is on one's right, and a stupendous and well-defined range it is. Its side towards the Thredbo is very steep and densely wooded right down to the Thredbo, which runs close to its base—a limpid stream carrying a good volume of water. Our track lies on the right bank of the Thredbo—that bank, of course, the most remote from the range. The grandeur of the scenery is unquestionable. As we pass along, the guide draws our attention to the Porcupine Mountain in this range, and high in the air we faintly discern the Trigonometrical Station, and recollect that on the Pretty Point route we view Porcupine Mountain only hundreds of feet below, while by the Thredbo route we see it from thousands of feet (over 2,000 feet) below. This range forms an immense escarpment on the Thredbo side.

As we continue to ascend the valley the river of course narrows, and the valley widens. We get out of forest country, and our route lies over undulating country, fairly grassed, with clumps of trees here and there. We have now arrived at a place in which the valley appears again to contract, and ranges spring up V-like from the stream on both sides. Here we ford the narrowing Thredbo, and ascend grassy hills for a few hundred feet. We pause to spell our horses, and to drink in the view of the upper valley, which now presents itself. The flat at our feet is Friday Flat. Beneath and before us we see the Thredbo fade away into a gradually-thinning silver line, while the steep valley is joined by other valleys until the scene passes into an infinite series of valleys and mountains displaying kaleidoscopic changes of colour, light, and shade. We all agreed that this view from Friday Flat was one of the most beautiful of our trip.

This view put us in high good humour. And now the struggle began. Our task was to ascend the Ram's Head Range, which had towered above us on our right for so long. The height above us had, of course, been steadily diminishing as we ascended the valley, but we had still to go 1,800 feet in vertical height to our camp on the tree-line.

We left the grass-land, and got into a dense scrub of Snow-gum (*Eucalyptus coriacea*). The trees were not above 20 feet high for the most part, but they were nearly as close as Mallee. A narrow track had been cut through this scrub, but we could not always keep to it, while the side of the mountain was very steep. Had it been grassed we could, of course, have "sidled" it, but we had to keep as nearly as we could to the steep track. Our pack-horses tried to shift their loads a good many times, and our saddle-horses had to rest frequently, for this was the steepest pinch of the whole trip; but they behaved splendidly, and finally brought us to the top, where we pitched camp at the tree-line, only a few paces from Rose's and Merritt's sheep-

camp. The camp was chosen other than from botanical considerations, but it proved to be the best head-quarters for botanising we could have selected. From our head-quarters we could botanise all over the elevated plains, could run up to Mount Kosciusko Peak, only 2 miles distant, and also visit the Ram's Head, Mueller Peak, Mount Twynam, &c. Our camp was only 200 or 300 yards distant from three large snow-drifts, was near small creeks innumerable, was adjacent to bogs and to the steep sides of the range, so that we could readily botanise over very diversified country.

Our steep track through the belt of Snow-gums was a struggle, but the sight of one plant therein will never be effaced from my memory. I allude to *Dianella tasmanica.* This plant occurred in large patches all through this scrub, and it was, without any exception, the handsomest plant we saw. Its blue flowers were borne in the greatest profusion, while its leaves were up to 6 feet long and 2 or 3 inches wide. We feasted our eyes upon it, and its abundance was the more remarkable, considering the paucity of blue flowers of any kind on the mountain. As I contemplated it, I thought of the high temperature of the Sydney Botanic Gardens, which would render perfect cultivation of this plant well-nigh impossible.

Having arrived at the tree-line by whatever route we may have selected, just a word about the descent. I recommend the descent *via* Pretty Point and Wilson's Valley. As I have dwelt upon this (though in a reverse direction) in my former paper, I need not detail it now, but I would like to say that future travellers this way have a great treat in store. As we descend, range after range bursts upon our vision like gigantic series of steps, causing the view to repeatedly change. The succeeding panoramas compelled exclamations of admiration from all of us, and I say, without hesitation, that beautiful as was the scenery during my ascent of January, 1898, and during the descent *via* Boggy Plain, both came very far short of the descent I have recommended. When we get below the tree-line we pass patches of small trees (all *Eucalyptus coriacea*) and belts of shrubs alternating with grass-land.

Eventually we got into forest country at Wilson's Valley. We here see *E. stellulata* commingle with the *E. coriacea,* and shortly afterwards a White Gum, probably undescribed, and soon occurs such forest undergrowth as *Helichrysum rosmarinifolium,* var. *thyrsoides*, *Daviesia ulicina, Bossiæa foliosa,* and *Hakea microcarpa.*

III.—Lake with two Outfalls.

About 2 miles from the summit of Mount Kosciusko we came across a small lake, or pond, which had two outfalls—one towards the Thredbo, and hence to the Snowy River, and the other towards the Murray. Few records appear to have been made on this subject, and hence some correspondence in *Nature,* vol. ix, 441, 485, and x, 5, 26, is interesting. It would appear that careful observations on the subject are still desirable, in order that there may be no difference of opinion as to facts.

IV.—Notes on the Climate.

My advice would be, "Never trust Kossy" (as the mountain is always called by the people of the district). We arrived at camp on the tree-line about noon, in balmy summer weather; the nights were bitterly cold and windy as usual, but in twenty-four hours after our arrival the thermometer went down to zero, with biting winds. Snow set in during the afternoon, and we were snowed up for two days. The weather then became less severe, but remained boisterous and threatening for the remainder of our stay. The wind-pressure at these high elevations must be extraordinary. On one occasion our party was proceeding from Lake Albina to the Blue Lake. While passing along a ridge near Mount Twynam the wind was so strong that I thought some of us would be blown, horses and all, over the ridge. The force of the wind as it came howling up the Wilkinson Valley was simply terrific, and I, for one, wondered whether the horses would much longer continue to endure these onslaughts. We guided the horses so as to give as little broadside to the wind as possible, and they behaved admirably. It is remarkable what these mountain-bred horses will endure. They are not much to look at, but they are docile and sure-footed, and will work for a long day. Then they are turned out and feed on the natural pastures. Such a thing as bringing up food for them is never thought of, neither is their toilet attended to. If one of these horses were shown a rug or operated upon with a brush or curry-comb, I am afraid he would be quite frightened.

During the time we were snowed up the horses were quietly feeding on the high lands; but occasionally disaster overtakes even this hardy animal. When the falls of snow are severe the horses take shelter around the granite rocks, but sometimes the snow drifts up and does not thaw for a long period. The horses are consequently imprisoned and starved. Near the Porcupine Rocks a road party decorated a granite mass with a dozen skulls of wild horses (broombees) that were snowed up within a few feet of each other last year.

As regards the human animal, when the wind is both cold and of high velocity, no clothing seems to keep one warm. Walk one cannot, except on a flat surface, and horse-riding at little more than a walking pace does not warm one. The only thing to be done is to get into shelter, drink hot bovril or tea, and eat. And it is remarkable how much one can eat. The coarsest fare is acceptable, and is devoured abundantly. Then one gets warm again.

We visited the summit a week later than last year, and the day was much milder. Nevertheless there was much more snow on the ground than last year, particularly on Mount Twynam. The view to the summit was good on the occasion of our visits, but the atmosphere had not the remarkable clearness which I experienced on my visit of a year previous. I should think it unlikely that the clearness of the atmosphere on that occasion would often be equalled, while it would be almost impossible to surpass it, so that I hardly felt disappointed in January, 1899.

The glare of the country in the higher parts of Mount Kosciusko is very trying to the eyes, particularly after a fall of snow, or when one is near the permanent snow masses or drifts. For that reason I would advise visitors never to omit a pair of goggles from their equipment.

One very readily gets sunburnt on Mount Kosciusko. To prevent this, or to alleviate the soreness of the sunburn, lanoline is excellent. It is now packed in collapsible tubes which are very convenient for the traveller. Vaseline and a much-advertised ointment which has vaseline for a base were found to be useless, or nearly so, for sunburn.

V.—Bibliography.

(Continued from page 726 of my former article.)

Including extracts from Lhotsky's and Mueller's travels.

Betche, E, see Maiden, J. H., and Betche, E.

Clarke, Rev. W. B.

Researches on the Southern Gold-fields of New South Wales. Sydney. Reading and Wellbank, 1860.

The following notes are additional to those given in my former paper, *Agricultural Gazette*, July, 1898, p. 725 :—

Chap. vii (pp. 115–117) is entitled, "Auriferous localities in the south-west of Maneero, and on both flanks of the Alps as far as Omeo." At p. 117 is Report No. vii, dated Jindebein (Jindabyne), county Wallace, 24th December, 1851.

"I had thus the satisfaction of passing with my whole train of eleven horses and seven attendants over the highest part of the Muniong Range, and of remaining part of two days and sleeping one night within a few yards of the snow of Mt. Kosciusco, first rendered remarkable by the visit of the Count Strzelecki. I then descended along the rough and very difficult slopes on the right bank of the Crack-em-back, following the usual course of the torrent from its western source."

P. 125. Notes on the granite about Kosciusco.

P. 127. Notes on the topography of Mt. Kosciusco.

Notes in regard to Kosciusco, Snowy River, Crackemback, Muniong Range, &c., are scattered throughout the volume.

P. 221. A small woodcut—eastern view of Kosciusco and the southern end of the Muniong Range, December, 1851. From a sketch by the author.

The work also contains a report by T. S. Townsend, late Deputy Surveyor-General, dated Camp, near Moamba, in regard to Crackemback, &c.

P. 232. An account of the Mount Kosciusko vegetation, supplied by Mueller. See p. .

Furber, T. F.

The trigonometrical survey of New South Wales, with mention of similar surveys in the other Australian Colonies. *Proc. Aust. Assoc. Adv. Science*, vii. Diagram and references to Mount Kosciusko, at pp. 198 to 201.

Helms, R.

Report of a collecting trip to Mount Kosciusko (abridged from his report to the Curator). *Records of the Australian Museum*, Vol. 1, pp. 11–16 (1890).

A brief yet interesting article, chiefly dealing with geology and zoology.

Helms, R.

Report on the Grazing Leases of the Mount Kosciusko Plateau. *Agric. Gaz. N.S.W.*, iv, 530 (1893).

A brief article dealing with the subject from the point of view of the pastoralist.

Kitson, A. E.

Geological Notes on the Gehi and Indi Rivers and Monaro track, Mt. Kosciusko. New South Wales. *Proc. R. S., Vict.*, ix (new series), 22.

Contains some valuable topographical information, principally as regards the Victorian side of the mountain.

Kitson (A. E.) and Thorn (W.)

Contributions to the Geology of Mt. Kosciusko and the Indi-Monaro track, New South Wales. *Proc. Aust. Assoc. Adv. Science*, vii, 367.

Contains some useful topographical notes and a double-page map of the district.

Jaquet (J. B.)

Geological Notes on a Trip to Mt. Kosciusko, New South Wales. *Records Geol. Survey, N.S.W.*, V, Pt. iii, 113. Partly published as "Report on the Jinderbyne District," in *Ann. Rep. Dept. Mines and Agric. N.S.W.* for 1896 (1897), p. 133.

A valuable report, but almost excusively geological.

Lendenfeld, R. von.

Report on the results of his recent examination of the central part of the Australian Alps. Addressed to the Minister for Mines, Sydney, dated 21st January, 1885, and published by the Government Printer, Sydney. Foolscap, 16 pp., two plates of photographic views and two folded maps and panoramic views of the district.

Von Lendenfeld's Mt. Kosciusko is the mountain with the bee-hive shaped stone cairn, now known as Mueller's Peak. He collected nineteen plants at various heights. The geological and topographical results have been dealt with by Helms, Curran, and others.

Lhotsky, Dr. John. See also below, p. .)

A Journey from Sydney to the Australian Alps, January-March, 1834. Being an account of the geographical and natural relation of the country travelled, its aborigines, &c., together with some general information respecting the Colony of New South Wales. Sydney, 1835. Sold by J. Innes, Bookseller, Pitt-street. 8vo.

I have seen this work described sometimes as of 64 pp.; but the copy in the Sydney Public Library has 110 pp., and finishes abruptly. A pencil note in this copy states, "All published."

Part the Second, p. 90 . . is styled, "Travels Through and Description of Menero Downs." The account is discursive, and the particulars of the Downs very brief. One could have desired to have seen the work completed. There are brief botanical notes at pp. 96, 97, near "Ballebalaing." At p. 107 is a reference to a spring on Menero (? Rock Flat Spring, near Cooma), with another botanical note or two. See also p. 79. He speaks very contemptuously of having been shown "specks of gold," adding that he knew it was always mica. At the same time much gold has since been won on the Monaro and Australian Alps.

[In the "Geographical Memoirs on New South Wales," &c., edited by Barron Field, is a paper entitled "Journal of an Excursion to the Southward of Lake George, in New South Wales," by Capt. Mark John Currie, R.N. The paper is dated 1823, is a brief one, and is accompanied by a map, which at the south-east corner has a range called "Morumbidgee Mountains," with these particulars:—"Lofty range of hills extending to the south, covered with snow (in June). The range probably communicates with the mountains behind Cape Howe." These mountains were probably a continuation of the Australian Alps, and Lhotsky (who seems to have been of a bilious temperament) sneers a good deal at this portion of the map.]

Lhotsky, Dr. J.

Some remarks on a short vocabulary of the Natives of Van Diemen's Land; and also of the Menero Downs in Australia. *Journ. Roy. Geog. Soc.*, 1839, pp. 157–162.

As some of the country traversed was in the vicinity of the Australian Alps, the following names of vegetable products and plants are of some interest:—

Acacia	Nirwan	Box-tree	Kanea Yarma
Gum-tree	Nirwan	Banksia	Pirruka
Gum, White	Bridgaong	,, fruit	,, Atyango
Bark	Parrunga	,, honey ...	,, Goa
Branch	Palluk	,, seed	,, Yua
Leaf	Kundika	Kangaroo Grass ...	Mallak
Tree	Waddi	Tea-tree	Gambar
Wood	Kayora		

Maiden (J. H.) and Betche (E.)

Notes from the Botanic Gardens, Sydney, No. 4. *Proc. Linn. Soc. N.S.W.*, 1899. Contains notes in regard to some Mt. Kosciusko plants, some of which are recorded as additions to the flora of New South Wales.

Mueller, F. (See below, pp. and .)

Mueller, Baron von (then Dr. F.)

Published descriptions of his Australian Alpine plants in the following papers :—

1. Definitions of rare or hitherto undescribed Australian plants, chiefly collected within the boundaries of the Colony of Victoria. Read 12th August, 1854; pp. 5–24.
2. Continuation of above paper. Read 14th November, 1854; pp. 34–50.
3. Descriptive characters of new Alpine plants from Continental Australia. Read 12th June, 1855; pp. 96–111.

[The above three papers are contained in the *Transactions of the Philosophical Society of Victoria*, Vol. i, 1855.]

No. 3 is especially interesting to the student of Mt. Kosciusko plants.

4. Description of fifty new Australian plants, chiefly from the Colony of Victoria. Read 6th November, 1854; pp. 28–48.
5. Description of new Australian plants, chiefly from the Colony of Victoria. Read 7th June, 1855; pp. 114–135.

Papers 4 and 5 are published in the *Transactions and Proceedings of the Victorian Institute for the Advancement of Science*, for the Sessions 1854–1855 (1855).

See also Mueller's paper, "An Historical Review of the Explorations of Australia," *Trans. Phil. Inst. Vict.*, ii., pp. 148-168. At p. 153 are a few notes referring to heights, &c., of Mt. Kosciusko and other peaks of the Australian Alps.

Stirling, J.

Notes on the flora of Mount Hotham. *Victorian Naturalist*, Sept., 1887, p. 72.

Although the list that accompanies this paper does not refer to Mt. Kosciusko, Mt. Hotham is of so high an elevation that the flora of the two mountains have much in common, and one or two of the Mt. Hotham species not yet recorded for Mt. Kosciusko probably only await the assiduous collector.

Strzelecki, P. E. de.

Physical description of New South Wales and Van Diemen's Land.

The author visited the district in 1840, according to Mueller, *Trans. Phil. Inst. Vict.*, ii, 153, approaching Mt. Kosciusko from the Victorian side. He was engaged in a survey of the New South Wales-Victorian boundary, and of the heights of prominent features generally. He gives the following heights :—

Mount Kosciuszko, Australian Alps		6,500
Mount Dargal	,,	5,490
Mount Pinnabar (Victoria)	,,	4,100
Cowrang Creek	,,	1,350

A description of Mt. "Kosciuszko" will be found at p. 62.

Sullivan, D.

On the Victorian Ranunculaceæ. *Victorian Naturalist*, March 1884, p. 19. (Abstract).

The greater part of this abstract is taken up with an account of the Ranunculaceæ found on Mt. Kosciusko, which, with true federal feeling, Mr. Sullivan long since felt to belong to Victoria; and, considering how much we owe to the botanists of the sister colony in the elucidation of the botany of the celebrated mountain, the feeling is quite reasonable.

Mr. Sullivan has useful notes on *Ranunculus anemoneus*, *rivularis*, *hirtus* (*plebeius*), *Millani*, and *Caltha introloba*.

The following extracts from Lhotsky and Mueller, describing their visits to Mount Kosciusko, or its neighbourhood, are of special interest at the present day, particularly to the botanical student:—

"Some data towards the Botanical Geography of New Holland, by Dr. John Lhotsky, late of the Civil Service in Van Diemen's Land."

. . . . "It begins in the valleys of the Alps, and reaches their summits, amalgamating, on one side, with that of the meadows or Minero Downs, and terminating on the other in a point which our present state of knowledge will not allow us to overstep. I have traced it to the summit of Mount William the Fourth,* certainly one of the loftiest among the Australian Alps. Supposing these mountains should somewhere rise to the elevation of perpetual snow, the extent of this latter class will, of course, be considerably increased. At all events, it is certain that the numberless peaks and rocky slopes of this chain must yield a great accession to the New Holland flora, even supposing that there should be no great novelty in the genera and species of the plants that grow there. As the differences of latitude between the Australian Alps and the Table Mountains of Van Dieman's Land is only five degrees, it must be presumed that although the former mountains be several thousand feet higher† than the latter, yet that many of the productions of the Table Mountain will also occur on the Alps,‡ and when it is taken into consideration that Dr. Brown ascended the Table Mountain no less than nine times, the chance of discovering any very remarkable novelties on the yet unexplored heights of New Holland is much diminished. One species of Eucalyptus *E. coriacea*, A. Cunn.—[J.H.M.], growing from twelve to twenty feet high, is the only tree that rewarded my researches among the Alpine vegetations; but some rangers and stock-keepers having assured me that a large tree of a particular kind may be seen in one of the valleys, most probably a species of *Atherosperma*, there assuredly remains something yet to be detected and indentified in this class of vegetation. The soil in this division is primitive, and in those spots where I most closely studied this department of Australian vegetation—I mean in Napoleon's Valley§ and on Mount William the Fourth—I everywhere found the formation to be of coarse-grained granite, upon which rests a stratum of vegetable mould, covered with sphagnum. A characteristic feature in these localities consists in the tracts which for miles are covered with dead timber (the small Eucalyptus), killed during severe winters by the vast accumulation of snow; a fact, however, upon which, inasmuch as it rather belongs to Physical Geography than Botany, I shall not here dilate. The characteristic plants of this class are two species of *Gentian*,[1] a *Mniarum*,[2] and *Sphagnum*, a new *Dracophyllum*,[3] *Pentachondra*, *Aseræ*, *Galium*, *Veronica* (n. sp.), *Leptorhynchus*, *Callitriche* (?), *Eurybia*[4] (several species), *Acrostichum australe*,[5] *Coprosma*, *Podolepis* (some of them three feet high), and several *Umbelliferæ* of very extraordinary aspect. All the most remarkable plants that I collected during my expedition are deposited in the British Museum."—(*The London Journal of Botany*, Ed. by Sir W. J. Hooker, ii, 140, 1843."

"Botany of Victoria (Southern Australia, *sic*). Extracts of letters from Dr. Mueller, Colonial Botanist, Victoria."

Omeo, 16th December, 1854.

"After a prosperous journey over the central part of the Australian Alps, I will occupy a leisure hour or two to acquaint you briefly with the botanical results of my researches.

* Mr. E. Twynam, Chief Surveyor of New South Wales, writes to me:—"The names, 'Mount King William IV' and 'Napoleon's Valley' are not known, and, I think, were never recognised; for your satisfaction, I have inspected all the old maps, inclusive of Townsend's survey, and there are no such names thereon."

† *Author's footnote.*—According to a calculation made from the temperature, viz., 196 degrees, at which water boiled on the summit of Mount King William the Fourth, this mountain has an elevation of 8,000 feet.

‡ This has since been abundantly proved. See below, p. .

§ *Ante*, p.

[1] Only one species of *Gentian* is known, viz., *G. saxosa*. [2] Probably *Scleranthus mnarioides*. [3] Probably *Richea Gunnii*. [4] *Olearia* (*Aster*). [5] Perhaps *Aspidium aculeatum* is intended.

"Although I wrote to you only about a month ago, when returning from Mount Wellington (in Gippsland), I hope that another communication now will not be altogether unacceptable, as Dr. Jos. Hooker's master mind and diligent hands are now occupied in the elucidation of the Tasmanian flora, for which a few observations on the plants lately gathered here may prove useful.

"The want of time hardly permits me to enter into any other subjects but botanical; still, I shall briefly mention that I am the first and only white man who has ascended the two highest summits in the Bogong Range, probably the loftiest in this continent, which will receive the names of Mount Hotham and Mount Latrobe, if His Excellency the Lieutenant-Governor should be pleased to sanction them. Other snowy mountains, which my bearing will connect with those already included in the trigonometrical survey of Australia, I beg leave to name in respect to the following men:—Hooker's Plateau, Mount Leichhardt, Kennedy's Height, Mitchell's Highland, and Clarke's Peak. The boiling-water point was on the tops of Mount Hotham and Mount Latrobe, equally 198 Fahr. (75° Réaum.), although the former exceeds the altitude of the other by a few hundred feet. This equality was, of course, owing to the variation in the atmospherical pressure whilst the two observations took place.

The vegetation of these lofty mountains cannot boast of so many peculiarities as I anticipated; repetitions of Tasmanian forms, or of such as I had already observed in other parts of the Australian Highland, were by far prevailing. Amongst other novelties was a dwarf Ranunculaceous plant, perhaps a *Caltha** with sagittate heart-shaped leaves, of which the lower lobes are inflexed in a most remarkable manner. It was ripening its fruit at this time, and the white sepaled flowers must be already developed, like those of the snowdrop, when everything around is clothed in snow. The ice-cold water which flows over its root, and against which the petioles are secured by a slimy tegument of decayed tissue, cannot reach the fresh green of the leaves, owing to the singular direction which they assume. The furrowed scape is either very short or the always solitary flower sessile. It is accompanied by two species of *Oreobolus*[1], by a *Drosera*, with a long creeping root, allied to *D. Arcturi* (growing out of *Sphagnum*) by a white flowering *Richea*[2], *Pentachondra pumila*, *Ranunculus Millani*, a very fragrant *Stackhousea*[3] (hardly rising above the ground), *S. pulvinaris*, and other truly Alpine plants. *Orites diversifolia*[4] (if not a distinct species, for I never saw it with toothed leaves) is frequent over the snowy regions of the mountain, as well as the *Calluna*-like shrub, which may be a kind of *Schidiomyrtus*.[5] Of an umbelliferous genus, described by Dr. Hooker, I now possess the first specimens, knowing it alone from Walper's work. I cannot, at present, remember its name. A *Ranunculus*—I presume your *R. cuneatus*—grows not only along with *R. Gunnianus*, but also frequently enough in an altitude considerably below that species.

You may imagine, Sir William, what a hearty welcome our old acquaintance, *Alchemilla vulgaris*, had when I found a few individuals of it here in the very heart of the Alps, viz., at the sources of the Mitta Mitta, not having seen this plant during the last seven years, when I left my native home. With yet greater pleasure I collected specimens of a *Veronica*, not unlike *V. serpyllifolia*, which grew there and here only, as well as *Geum urbanum* and *Barbarea vulgaris*, promiscuously with *Alchemilla*. A white flowering *Viola*, with cordate leaves, assists in the imitation of European plants, but does not venture to ascend to the high localities, with so inclement a climate, to which the others penetrate. A peculiar *Leucopogon* and two or three species of *Epacris* form also additions to the Victorian flora. From the lower country I obtained *Calystegia marginata*, which, I think, is only a small flowering variety of *C. sepium*; further, a little blue *Pigea or Ionidium*, not unlike a *Utricularia*, from the seeds of which I hope you will have a fine additional pot plant for your garden. *Carex Preissii*, a *Pomaderris*, and an *Ozothamnus*, not previously found here, but identical with Van Dieman's Land species, but a charming *Boronia (B. bijuga)* and a *Pimelea (P. axillaris)* seem to belong exclusively to these mountains. I have convinced myself now, also, that the true "locus natalis" of *Grevillea Victoriæ*, which I saw here in all its glory, is the Alps; but the fruit was only developing and I could not obtain a grain of seed from it. What an introduction to Kew Gardens this plant would be—a plant that requires no protection in England, and will grow along with *Ligustrum*, *Honeysuckle*, and *Lilac*! Of a rufous *Prasophyllum*, perhaps *P. fimbri-*

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* *C. introloba*, F. v. M.

[1] Merged in *O. Pumilio*, R. Br. [2] *R. Gunnii*, which, by an oversight, was not recorded as a New South Wales species until a few years ago. [3] *S. pulvinaris*. [4] *O. lanceolata*, *O. diversifolia* not having yet been found out of Tasmania. [5] Probably *Kunzea Muelleri*.

atum, I could not find more than a solitary specimen. In vain I searched for the splendid Pines of Tasmania, for *Pimelea nivea*, and many other plants which adorn the mountains of that island. I hope to be more lucky at Mount Koskiusko,* for which I am now steering. To the Cobboras I shall, in passing by, pay a visit again."—*Hooker's Journal of Botany and Kew Garden Miscellany*—vii, 233. (1855.)

Buchan River, 22nd January, 1855.

"Since I had the honor of addressing you last from Omeo, I proceeded to the north-western branches of the Australian Alps, where I ascended all the most prominent heights, including Mt. Koskiusko. I found the distribution of the Alpine plants during this excursion to be more general, as I anticipated; but had the pleasure of first observing many species here in a sufficiently developed state to form a correct idea of them. Of most of the new species I procured a good supply, which I had, however, a great difficulty to keep dry against fog, and afterwards, in the lower ranges, against rain; only a few had ripened seeds. I am now preparing to revisit the cabbage-tree country, beyond the Snowy River, which I had (on account of many unforeseen adversities—the hostility of the natives, and the unfavourable weather) but little opportunity of exploring last year. I shall only be enabled to allude briefly to the more interesting plants from the Alps, which I lately discovered. One of the most remarkable amongst them is assuredly a large-flowering *Ranunculus*,[1] with generally numerous and always white petals, having much the habit of an *Anemone*. It grows very seldom below 6,000 feet, and chiefly on springs and on the margin of melting snow. Five *Umbelliferæ* belonging to as many distinct genera, are associated with it, as also a dwarf inconspicuous Composite, with leaves much like *Orebolus*, a slender procumbent *Pentachondra* ?, a monostachyous *Carex*, a rooting *Gnaphalium*, a very distinct *Plantago*, and a smooth *Craspedia* (*C. leucantha*),[2] with white flowers and sphacelate scales. At the highest mountains on stony ground, I was not a little struck with a diandrous plant allied to *Veronica*, having the leaves densely crowded in four rows.[3] Accompanied it was with a small hispid *Haplopappus*, and with a moss-like tufted *Arenaria*. The Ranunculaceous Caltha-like plant with inward bent leaves, to which I previously referred,[4] is frequent enough on the Munzang Mountains, and after having seen it in a more advanced state I am much inclined to refer it to *Caltha*. I am, however, entirely deprived of books during the expedition, so as to settle these questions at once. Singularly enough, *Carex stellulata* fell into my hands abundantly in some parts of the Alps, occurring like *Alchemilla vulgaris* and *Veronica serpyllifolia*? None were in the lowland. *Lycopodium varium*, which appears hardly to be distinct from *L. Selago*, and *Botrychium Lunaria* belong also to higher country; but one of the most interesting additions to our Alps flora forms is undoubtedly a little annual *Euphrasia*. *Orites*, the species from Mount Hotham, I saw ranging for miles along with a fine ovate-leaved lepidote *Eriostemon* or *Phebalium*.[5] It has always entire leaves, and I may, therefore, consider it a new species (*Orites planifolia*).[6] *Coprosma nitida* is not rare in the Snowy Mountains, and two herbaceous plants, apparently new, of the same family, were also discovered in the lower country, together with a second species of *Solenogyne* (*S. pubescens*), a *Velleya*, which, in Stuart's Herbarium, I called *V. exigua*, a *Rutidosis*, I suppose *R. helichrysoides*, *Scirpus Rothii* (*S. triqueter*, R. Br.), and a very distinct *glandular Calotis*.[7] Two interesting mosses were growing on rocks, which are constantly washed by melting snow, one of them adding the genus *Andræa* to the flora of New Holland.

After having traversed now the main chains of the Snowy Mountains in so many directions, that I am led to believe that the plants mentioned in this and the two previous letters, and those noticed in my reports, comprehend almost completely the Alps flora of this continent, I wandered for days over the Snowy Mountains without being able to add a single species to the collections."—(*Hooker's Journal of Botany and Kew Garden Miscellany*, VII, 235–6, 1855.)

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* With hardly an exception the plants enumerated in this letter are also Mount Kosciusko plants.

[1] *R. anemoneus*; the observation as to its habitat would appear to be scarcely correct; it seems to prefer crevices of granite boulders. [2] *C. Richea* (with orange coloured flowers). [3] *Veronica densifolia*. [4] *Caltha introloba*. [5] *Phebalium ovalifolius*. [6] *Orites lancifolia*. [7] *C. glandulosa*.

VI.—List of the Plants Collected.

It was my original intention, as regards the plant lists, simply to supplement those given in my former paper, but I propose to improve upon the geographical distribution therein indicated. I give notes under each locality, and where the zones are altered I have given a full list of the plants collected therein.

Further on (p.), reference will be made to the identity of many species with those of Tasmania. The letter **T** preceding a species name indicates that it is also found in Tasmania.

1. *Jindabyne (Snowy River).*

[Previous reference, 1898 *Gazette*, p. 726.]

Following are additions to the previous list:—

CRUCIFERÆ.

T *Nasturtium palustre* DC. (Syn. *N. terrestre*, R. Br.) (banks of the Snowy).

CARYOPHYLLEÆ.

T *Sagina procumbens*, Linn. (banks of the Snowy).

HYPERICINEÆ.

T *Hypericum japonicum*, Thunb.

LEGUMINOSÆ,

Acacia prominens, A. Cunn.
Swainsona phacoides, Benth.
T *Lotus australis*, Andr.
T *Lotus corniculatus*, Linn.
Bossiæa foliosa, A. Cunn., very abundant.

ROSACEÆ.

T *Rubus parvifolius*, Linn.

CRASSULACEÆ.

T *Tillæa verticillaris*, DC.

UMBELLIFERÆ.

T *Trachymene (Didiscus) humilis*, Benth. A neat little plant in moist places in grass land.

RUBIACEÆ.

T *Galium umbrosum*, Soland. (Syn. *G. Gaudichaudi*, DC.)

COMPOSITÆ.

T *Cassinia aculeata*, R. Br.
T *Brachycome diversifolia*, Fisch. & Mey.
T *Brachycome stricta*, DC.
T *Brachycome scapiformis*, DC.
T *Senecio lautus*, Forst.

STYLIDEÆ.

T *Stylidium graminifolium*, Sw.

EPACRIDEÆ.

T *Leucopogon Hookeri*, Sond.

BORAGINEÆ.

T *Myosotis australis*, R. Br. Flowers uniformly white as seen; a neat little plant.

SCROPHULARINEÆ.

T *Veronica plebeja*, R. Br.

LABIATÆ.

T *Ajuga australis*, R. Br.

PLANTAGINEÆ.

T *Plantago varia*, R. Br.

PARONYCHYEÆ.

T *Scleranthus diander*, R. Br.
T *Scleranthus biflorus*, Hook., f.

THYMELEÆ.

T *Pimelea hirsuta*, Meissn.
T *Pimelea linifolia*, Sm.

AMARYLLIDEÆ.

T *Hypoxis hygrometrica*, Labill.

JUNCEÆ.

T *Juncus falcatus*, E. Mey.
T *Luzula campestris*, DC.

CYPERACEÆ.

T *Scirpus setaceus*, Linn.
T *Carex cæspitosa*, R. Br.
T *Carex inversa*, R. Br.

GRAMINEÆ.

T *Panicum effusum*, R. Br.
T *Deschampsia cæspitosa*, Beauv. On the banks of the Snowy River.
T *Deyeuxia Forsteri*, Kunth.
T *Deyeuxia breviglumis*, Benth. On the banks of the Snowy. Found also at Sawpit Creek. These localities are the most southerly yet recorded from this rather rare grass. (See Maiden and Betche, in *Proceedings Linnean Society, N.S.W.*, 1899.)
T *Poa cæspitosa*, Forst.
T *Agropyrum scabrum*, Beauv.

FILICES.

T *Lomaria alpina*, Spreng. This fern will be found right up to the summit of Mount Kosciusko.

T *Ophioglossum vulgatum*, Linn. In moist patches on the banks of the Snowy. *Botrychium* may be expected to be found on some part of Mount Kosciusko.

2. *Sawpit Creek.*

[Previous reference, 1898 *Gazette*, page 729.]

Following are additions to the previous list of Sawpit Creek plants. On the ascent *viâ* Thredbo we crossed Splitters' Creek, at about 9 miles from Jindabyne. The vegetation on that creek is precisely similar to that of Sawpit Creek.

RANUNCULACEÆ.

Ranunculus plebejus, R.Br.
T *Ranunculus parvifolius*, Linn.

GERANIACEÆ.

T *Geranium dissectum*, Linn.

LEGUMINOSÆ.

T *Psoralea adscendens*, F.v.M.

COMPOSITÆ.

Olearia alpicola, F.v.M., var. *aglossa*, Maiden and Betche. (New variety; see *Proc. Linnean Society, N.S.W.*, 1899.) Jindabyne, W. Bauerlen, January, 1890; Sawpit Creek, Mount Kosciusko, J. H. Maiden, January, 1898 and 1899. Differs from the broad-leaved form of *Olearia alpicola* in the absence of the ray-flowers, in the fewer flowers in the heads (five to seven in the heads examined), and in the pinkish tint of the pappus-bristles. Specimens of *O. alpicola* from the Cobberas Mountains in Victoria, collected by F. v. Mueller, as well as specimens from Woolls' Herbarium, without locality, agree precisely with the rayless Mount Kosciusko form, except in the presence of the ray-flowers.
T *Brachycome stricta*, DC.
T *Cotula alpina*, Hook. f.
Podolepis longipedata, A. Cunn., var., *robusta*.
Helichrysum rutidolepis, DC.
T *Helichrysum semipapposum*, DC.
T *Raoulia Catipes*, Hook. f.
T *Erechtites arguta*, DC.

LABIATÆ.

T *Prunella vulgaris*, Linn.

PROTEACEÆ.

T *Hakea microcarpa*, R.Br. (*H. pugioniformis*, Cav., in my former list of Mount Kosciusko plants is probably a mistake; at all events, I cannot find it in my herbarium).

CYPERACEÆ.

Carex declinata, Boott.

GRAMINEÆ.

Deyeuxia breviglumis, Benth. (See note at p. .)
T *Deyeuxia Forsteri*, Kunth.
T *Poa cæspitosa*, Forst., var. *latifolia*.
T *Agropyron scabrum*, Beauv.
Festuca bromoides, Linn. An introduced plant, is getting common here

FILICES.

T *Lomaria alpina*, Spreng.
T *Asplenium flabellifolium*, Cav. This small fern has not previously been recorded from Mount Kosciusko.

3. *Thredbo River.*

The Crackenback is another name for this stream. As we followed this river for a considerable distance, which I did not do in my 1898 journey (only crossing it), I give a full list of the plants collected in its valley, as none of the lists given in my last paper give plants collected on the Thredbo.

RANUNCULACEÆ.

T *Ranunculus lappaceus*, Sm.

MAGNOLIACEÆ.

T *Drimys aromatica*, F.v.M.

POLYGALEÆ.

T *Comesperma retusum*, Labill.

CARYOPHYLLEÆ.

T *Stellaria pungens*, Brong.

RUTACEÆ.

Phebalium lamprophyllum, Benth. (*Eriostemon lamprophyllus*, F.v.M.) A yellow flowering, narrow-leaved shrub, 3 or 4 feet in height, and forming dense masses as the Upper Thredbo is approached.

RHAMNEÆ.

T *Discaria australis*, Hook. A broad-leaved form ; shrubs 10 to 15 feet in height.

LEGUMINOSÆ

Oxylobium alpestre, F.v.M.
T *Daviesia ulicina*, Sm.
Swainsona phacoides, Benth.
Bossiœa foliosa, A. Cunn.
T *Pultenœa fasciculata*, Benth.
T *Acacia penninervis*, Sieb. (broad-leaved variety).
T *Acacia siculiformis*, A. Cunn.

ROSACEÆ.

T *Geum urbanum.*, Linn (in a swamp).

HALORAGEÆ.

T *Haloragis depressa*, Walp.

MYRTACEÆ

Kunzia Muelleri, Benth.
T *Leptospermum lanigerum*, Sm.

UMBELLIFERÆ.

T *Trachymene (Didiscus) humilis*, Benth.

RUBIACEÆ.

T *Coprosma hirtella*, Labill.

COMPOSITÆ.

Olearia megalophylla, F.v.M.
T *Olearia stellulata*, Labill.
T *Brachycome scapiformis*, DC. With large purple heads of flowers ; well worthy of cultivation.

T *Craspedia Richea*, Cass.

T *Cassinia aculeata*, R.Br. Broad-leaved form. It would appear, from material from Mt. Kosciusko, that there is no real line of demarcation between this form and *C. longifolia*, var. *straminea*. Attention is invited to the matter.

T *Leptorrhynchus squamatus*, Less.
T *Helipterum incanum*, DC.
T *Senecio lautus*, Forst.
T *Senecio odoratus*, Horn.
T *Picris hieracioides*, L.

GOODENIACEÆ.

Goodenia hederacea, Sm. A beautiful plant, with white under-sides to the leaves. More ornamental than the normal species. This white tomentum is common in plants of this species in the coldest parts of the Colony, particularly in the extreme south; it is also well marked in New England specimens.

CAMPANULACEÆ

T *Lobelia pedunculata*, R.Br.

EPACRIDEÆ.

T *Epacris heteronema*, Labill.
T *Leucopogon Hookeri*, Sond.

BORAGINEÆ.

T *Myosotis australis*, R.Br.

SCROPHULARINEÆ.

T *Veronica Derwentia*, Andr.

LABIATÆ.

T *Prostanthera cuneata*, Benth.
T *Prostanthera lasianthos*, Labill.

PROTEACEÆ.

Grevillea lanigera, A. Cunn.
T *Grevillea australis*, R.Br.
T *Hakea microcarpa*, R.Br.

THYMELEÆ.

T *Pimelea ligustrina*, Labill.

CONIFERÆ.

T *Podocarpus alpina*, R.Br. An erect shrub of 4–5 feet on the banks of the Thredbo.

ORCHIDEÆ.

T *Microtis porrifolia*, Spreng.
T *Pterostylis mutica*, R.Br.
T *Prasophyllum patens*, R.Br.

LILIACEÆ.

T *Arthropodium paniculatum*, R.Br.

T *Dianella tasmanica*, Hk. I have alluded to the gorgeousness of this plant at p. .

JUNCEÆ.

T *Juncus pallidus*, R.Br.
T *Xerotes longifolia*. R.Br.

GRAMINEÆ.

T *Dichelachne sciurea*, Hook., f.
T *Poa cæspitosa*, Forst., var., *latifolia.*
Hordeum murinum, L. This weed is well acclimatised here.
T *Danthonia penicillata*, F.v.M. (*D. racemosa*, var. : *biaristata.*)
Deyeuxia (*Agrostis*) *densa*, F.v.M. New for New South Wales. See Maiden and Betche in *Proc. Linn. Soc.*, *N.S.W.*, 1899.

FILICES.

T *Lomaria alpina*, Spreng.
T *Hymenophyllum tunbridgense*, Sm. On banks of Thredbo.

4. *Pretty Point.*

I collected but few plants at this locality last year; on the present occasion we spent several hours collecting in the neighbourhood, and the following list may be serviceable. The vegetation of Mt. Kosciusko and Pretty Point has a large number of species in common.

As we approached Pretty Point from Mt. Kosciusko the following conspicuous plants appear to drop out—

Aciphylla glacialis, F.v.M., its place being taken by *A. simplicifolia* F.v.M., while the following prominent plants make their appearance :—

Restio australis, R. Br.
Veronica Derwentia, Andr.
Olearia megalophylla, F.v.M.
Bossiæa foliosa, A. Cunn.
Hovea longifolia, R. Br., var. *lanceolata.*
Pultenæa fasciculata, ? Benth.
Callistemon pityoides, Miq.

RANUNCULACEÆ.

T *Ranunculus lappaceus*, Sm.

MAGNOLIACEÆ.

T *Drimys aromatica*, F.v.M.

VIOLARIEÆ.

T *Viola betonicæfolia*, Sm.

CARYOPHYLLEÆ.

T *Stellaria pungens*, Brong.

PORTULACACEÆ.

T *Claytonia australasica*, Hk. (in peaty bed of creek).

LINEÆ.

T *Linum marginale*, Cunn.

GERANIACEÆ.

T *Geranium dissectum*, L. May frequently be seen in large masses, after a fire, being the only plant to be seen over a considerable patch of ground.

LEGUMINOSÆ.

T *Oxylobium ellipticum*, R. Br., var. *alpinum.*
T *Bossiæa foliosa*, A. Cunn.
T *Hovea longifolia*, R. Br., var *lanceolata.*

ROSACEÆ.

T *Rubus parvifolius*, L.
T *Acæna sanguisorbæ*, Vahl.

DROSERACEÆ.

T *Drosera peltata*, Sm.

HALORACEÆ.

T *Haloragis depressa*, Walp., forming mats in wettest places.

MYRTACEÆ.

T *Baeckea gunniana*, Schau.
T *Eucalyptus coriacea*, A. Cunn. Many of the trees had been injured by fire, and the suckers from the trunk showed fasciation—a thing I have not previously noticed in the genus.

ONAGRARIEÆ.

T *Epilobium glabellum*, Forst.

UMBELLIFERÆ.

T *Hydrocotyle hirta*, R. Br.
T *Aciphylla simplicifolia*, F.v.M. A grass-leaved plant in grass land, Betts' Camp to Pretty Point.

ARALIACEÆ.

T *Panax sambucifolius*, Sieb.

RUBIACEÆ.

T *Galium umbrosum*, Sol.

COMPOSITÆ.

T *Olearia floribunda*, Benth.
Olearia megalophylla, F.v.M.
T *Celmisia longifolia*, Cass.
T *Erigeron pappochroma*, Labill.
T *Brachycome decipiens*, Hk.
T *Craspedia Richea*, Cass.
Podolepis longipedata, A. Cunn., var. *robusta*. See my former paper, p. 737. Less tomentose than higher up, and reminding one a good deal of a lettuce, when not in flower.
T *Helichrysum baccharoides*, F.v.M.
T *Helichrysum rosmarinifolium*, Less., var. *thyrsoides*. Common at Wilson's Valley.
T *Helipterum anthemoides*, DC.
T *Erechtites arguta*, DC.
T *Senecio pectinatus*, DC., var. *pleiocephalus*.
T *Microseris Forsteri*, Hk.

STYLIDEÆ.

T *Stylidium graminifolium*, Sw.

EPACRIDEÆ.

T *Epacris heteronema*, Labill.
T *Epacris serpyllifolia*, R.Br.
T *Richea Gunnii*, Hk.

GENTIANEÆ.

T *Gentiana saxosa*, Forst. Known locally as "Snowdrop."

BORAGINEÆ.

T *Myosotis australis*, R.Br.

SCROPHULARINEÆ.

T *Euphrasia Brownii*, F.v.M.
T *Veronica Derwentia*, Andr.

LABIATÆ.

T *Prunella vulgaris*, DC.

PROTEACEÆ.

T *Grevillea australis*, R.Br.
Lomatia longifolia, R.Br.

THYMELEÆ.

T *Pimelea ligustrina*, Labill.
T *Pimelea axiflora*, F.v.M., var. *alpina*.

EUPHORBIACEÆ.

T *Poranthera microphylla*, Brong.

SANTALACEÆ.

T *Exocarpus nana*, Hook., f. (New for N.S.W.) *Proc. Linn. Soc., N.S.W.*, 1899. A wiry plant a few inches high, forming a tangled mass encircling a rock in boggy ground. This plant has been confused with *E. humifusa*, R.Br. In our plant the scale-like leaves are all opposite, or nearly so, and not alternate, as in *E. humifusa*. *E. nana* is recorded from Victoria ("Summit of Cobberas Mountains, at an elevation of 6,000 feet"), while the true *E. humifusa*, R.Br., is only recorded from Tasmania.

CONIFERÆ.

T *Podocarpus alpina*, R.Br.

ORCHIDEÆ

Thelymitra venosa, R.Br.
T *Diuris pedunculata*, R.Br.

LILIACEÆ.

T *Dianella tasmanica*, Hk.
T *Astelia alpina*, R.Br.

RESTIACEÆ.

T *Calostrophus lateriflora*, Benth.
T *Restio australis*, R.Br.

CYPERACEÆ.

T *Scirpus cartilagineus*, Spr.
T *Schœnus Apogon*, Roem.

GRAMINEÆ.

T *Hierochloe redolens*, R.Br.

T *Agrostis scabra*, Willd. A dwarf ornamental grass with dark inflorescence.

T *Trisetum subspicatum*, Palis.

T *Poa cæspitosa*, Forst., var. *latifolia*. Common on creeks.

T *Agrostis scabra*, Willd. An elegant little grass, with dark inflorescence.

Deyeuxia (*Agrostis*) *densa*, F.v.M. New for N.S.W. (See *Proc. Linnean Soc., N.S.W.*, 1899.) Mount Kosciusko, 6,000 feet. R. Helms, February, 1893; Pretty Point, Mount Kosciusko, 5,500 feet. Mr. Helms' specimens are broad-leaved, and have the awn attached somewhat above the middle of the glume, while in the recently-collected specimens from Pretty Point the

leaves are narrower, and the awn is attached a little below the middle. In spite of the difference in the attachment of the awn, we must consider the two forms identical with Bentham's *Deyeuxia densa*, in which the awn is described as attached "about the middle."

In nearly all our Mount Kosciusko *Agrostis* we find the attachment and length of the awn, and even the comparative length of the flowering glume, unreliable characters, subject to great variations. Amongst the grasses recently collected on Mount Kosciusko by Maiden and Forsyth, we find *A. Muelleri*, Benth., in three distinct forms: The typical awnless form, another form with a very short awn or small point attached near the top, and a third form with an awn at least twice as long as the flowering glume attached near the middle. In all other respects the three forms are quite identical. *A. nivalis*, F.v.M., has also been collected in two forms, the one identical with the Victorian type specimen from Mount Buller, the other with the flowering glume considerably shorter than the outer glumes.

Mr. L. Rodway has made a similar observations in Tasmanian species of *Agrostis;* he writes in a private letter (with regard to *A. quadriseta*), "the typical form has the awn inserted below the middle, but in Tasmanian forms at least this is totally unreliable."

T *Deyeuxia frigida*, F.v.M. In a dry situation at the foot of a large rock-mass.

D. nivalis, Benth.

FILICES.

T *Aspidium aculeatum*, Sw.

T *Asplenium flabellifolium*, Cav.

T *Lomaria alpina*, Spreng.

The *Aspidium* and *Lomaria* are abundant on Mount Kosciusko from Jindabyne to the summit.

The following introduced plants were found to be fairly well established at Pretty Point:—

Dandelion (*Taraxacum Dens-leonis*).

Flat weed (*Hypochæris radicata*).

Sheep sorrel (*Rumex acetosella*).

Tree-line to 7,000 feet.

The height of the tree-line is fairly constant (about 6,500 feet). At all events it is a well-marked and definite line, and the zone from the tree-line to 7,000 feet (*i.e.*, the highest portions of the elevated tableland) is one of scientific demarcation. This zone exhibits a fairly uniform flora—that is to say, most of the plants enumerated are widely distributed over its area.

It contains what is most characteristic and most interesting of the Mount Kosciusko flora, and it is to this zone that we gave our greatest attention, and in which we spent the greatest part of our time. Where a Mount Kosciusko species exhibits variation—as, indeed, many of them do, some of them to a great extent—it will be found convenient to compare the forms with that found within the "tree-line to 7,000 feet" zone. This proposed zone will obviously include most of the plants given in my former list, "5,500 feet to summit."

Collecting Places.—The plain is bestrewn with masses of granite of various sizes, disposed singly and in heaps. These form excellent

shelter-places for plants, and several species are best collected in the crevices of such. Unfortunately, also (from the point of view of the botanist), these shelter-places are often sought out by sheep, who devour the specimens.

The whole plain is a carpet of verdure of one kind or another, and careful examination shows that there is by no means the sameness in the vegetation that at first sight there appears to be. The grasses furnish the ground-colour of course, but there are abundant patches of white-blooming *Epacris* and *Phebalium ovatifolius*, yellow *Oxylobium alpestre*, and scattered in the grass-land yellow *Ranunculi*, purple *Brachycomes*, masses of white daisy (*Olearia stellulata*), and silver daisy (*Celmisia longifolia*), and the handsome, though not showy, umbelliferous plant *Aciphylla glacialis*. Then there are little mats of the dainty *Stackhousia pulvinaris*, *Raoulia Catipes* and *Epilobium confertifolium*, and many other notable plants referred to in detail later on.

The plain is intersected in many directions with small streams—brooks they would be called in the old land—and their ragged sides afford a rich harvest of miscellaneous plants. As is common in granite country, there are endless blind channels, whose length is continually increasing, while the breaking down of the banks in parts causes holes of greater or less diameter, which are often nearly overgrown with plants, with the exception of a small opening. In daylight one has to proceed carefully, as one's horse (unless he be left to himself) may sink to his belly, while riding in such country after sundown is very dangerous. But from the point of view of the botanist, all these partially-concealed holes are very interesting, furnishing many specimens.

Then there are the innumerable shallow lagoons which are to be found all over the higher plains. They are usually only a foot or two deep, the depth being very uniform. They consist of the depressions formed by the wearing away of the layer of humus-laden soil from the hard granite-gravelly surface underneath. These lagoons sometimes form quite a maze, and the horses have to step from tongue to tongue of land to pass them. These lagoons are frequently stocked with one species, almost to the exclusion of all others. For instance, the floor of one lagoon may be seen to be dotted all over with *Ranunculus Millani*, like golden nails studding a floor of sombre colour. Then *Myriophyllum pedunculatum* is so abundant in another lagoon as to give the appearance of a bright red carpet, or, to choose a less pleasant but quite appropriate simile, of a floor stained with blood.

But by far the most interesting botanising places are the snow-drifts. These drifts occupy sheltered depressions, and are practically permanent at the greatest heights, the winter, spring, and autumn falls of snow only melting during the summer to a small extent. Some of them must be very deep, perhaps 50 or 100 feet in some places, but the surface is so consolidated that one can walk on it for some distance without much difficulty even without the aid of snow-shoes. Some of them are hundreds of feet across in any direction. As they are usually seen in summer they are not "snow-white," like the pure driven snow one sees in winter in Europe, for it is tinged with a dingy, reddish-

brown colour. This is owing to deposits of fine dust from the Riverina. At the edges of the drifts pellicles of this dust material can be readily obtained. Of course a day's snow soon transforms these drifts into masses of the most dazzling white—very beautiful, but very trying to the eyes. These drifts are always melting, and consequently from each one or more streams flow. These are, in fact, the beginnings of important rivers. Around the lower fringe of the drift where there is a constant exudation of water scarcely above zero in temperature, and along the early stages of these creeks are many interesting plants.

If at the edge of a drift a plant has finished flowering, the plant may perhaps be discovered in full flower if the snow be removed for a few inches, exposing its inflorescence and displaying its sweetness concealed from human eyes.

Some of the plants found in such situations are; all the *Ranunculi* except *anemoneus*, *Caltha introloba*, *Azorella*, *Diplaspis*, *Oreomrrhis pulvinifica*, *Abrotanella nivigena*, *Antennaria uniceps*, *Plantago Gunnii*, and *stellaris* and *Astelia alpina*.

Here follows a classified list of the plants occurring between the tree-line to an elevation of about 7,000 feet:—

RANUNCULACEÆ.

Ranunculus Millani, F.v.M. · Has small greenish-yellow flowers, and is commonly found at the bottom of shallow lagoons. In such situations it must be submerged for the greater portion of the period of its inflorescence, and one wonders what arrangements obtain to ensure fertilisation.

Ranunculus anemoneus, F.v.M. Unlike the other species, this does not grow in water or in very damp ground, but in the shade of rocks. It is a large white-flowered species, and as it usually flowers about November, immediately the snows melt, visitors to the summit in January only collect it in fruit, or obtain an odd flower or petal. Mr. Ingleby described this plant to me as being one of the handsomest on the mountain, which can very readily be believed.

T *Ranunculus Gunnianus*, Hook. Usually found at the foot of melting snows. This and the following two species have flowers of an intense yellow colour; certainly the colour is more intense than is usually seen at lower levels.

T *Ranunculus dissectifolius*, F.v.M. *Ranunculus lappaceus*, Sm. A dwarf form.

Ranunculus Muelleri, Benth. Usually found in the dry holes excavated by the water in the vicinity of the creeks.

T *Caltha introloba*, F.v.M. This is the plant concerning which Mueller wrote so enthusiastically to Hooker; see p . I did not see it last year, perhaps because the season was more advanced. It is a tiny plant with long tap-root and charming white flowers. It was found flowering under the snow. Besides this situation it was only found at the lower edge of snow-drifts, or in the stony beds of creeks bathed with water not much above zero. It was the only plant collected which was affected by a fungus. See p. .

MAGNOLIACEÆ.

T *Drimys aromatica*, F.v.M. Forming dense masses of stinted shrubs a the tree-line and below.

CRUCIFERÆ.

T *Cardamine hirsuta*, Linn.

T *Cardamine dictyosperma*, Hook. Neat little white flowering plants usually found amongst rock-masses. *C. tenuifolia* may also be expected to be found on Mount Kosciusko, but I did not collect it.

VIOLARIEÆ.

T *Hymenanthera dentata*, R.Br. Here a scrambling, stunted shrub, a great contrast to its exuberant growth on the Northern rivers.

T *Viola betonicæfolia*, Sm. A dwarf form, and also a very luxuriant one.

CARYOPHYLLEÆ.

Colobanthus subulatus, Hook., f.

PORTULACACEÆ.

T *Claytonia australasica*, Hk. Forms dwarf patches or mats of pale or glaucous green, with white flowers. A singularly pretty plant, well worthy of cultivation. Mr. Lucas took living plants to Sydney, and found that the new shoots became perfectly glabrous, the glaucousness of the plant thus disappearing under cultivation in a warmer climate.

GERANIACEÆ.

T *Geranium dissectum*, L.

T *Geranium sessiliflorum*, Cav.

RUTACEÆ.

Phebalium ovatifolium, F.v.M.

STACKHOUSEÆ.

T *Stackhousia pulvinaris*, F.v.M. One of the gems of the Alps.

LEGUMINÆ.

T *Oxylobium ellipticum*, R.Br., var. *alpinum*, Maiden and Betche.

ROSACEÆ.

Alchemilla vulgaris, Bauh. Banks of Lake Albina, under rocks.

T *Acæna sanguisorbæ*, Vahl. I saw both *Acænas* in situations which render it extremely probable that they are indigenous in the places in which they are found. I gave special attention to these plants, and do not doubt that they are natives of Mount Kosciusko. At the same time they have been carried about from place to place by human agency.

CRASSULACEÆ.

T *Tillæa verticillaris*, DC. (in place of *T. vulgaris*, Heyne, which is a slip of the pen, at p. 736 of my former paper).

DROSERACEÆ.

T *Drosera Arcturi*, Hook., f. Common on the gravelly edges of the Snowy River above the tree-line.

HALORAGEÆ.

T *Haloragis depressa*, Walp. Often forming a mere layer on moist rocks.

T *Myriophyllum pedunculatum*, Hook., f.; new for New South Wales. Lining the bottoms of shallow ponds near head of Snowy River, Mount Kosciusko; circa, 7,000 feet. The plant has a red cast, and gives the surface of the ground a red appearance. Previously recorded from the Australian

Alps in Victoria, Tasmania, and Western Australia. The flowers in our specimens are not pedunculate. I have alluded to the gory appearance of this plant at page 1029.

MYRTACEÆ.

T *Eucalyptus coriacea*, A. Cunn. Forming the "Tree-line." The trees of this species at the highest elevations are remarkable for their bare stems, surmounted with a dome or flattish top of leaves. The bare stems are, doubtless, the consequence of winds, the leaves being concentrated on the top as a thin "layer," and offering minimum resistance to the wind. These dwarf trees are in masses of a fairly uniform height; a different arrangement would result in the crown of leaves of the smaller plants being beaten against the bare stems of their taller brethren, and denuded of their foliage. The grotesque leaning forms of the stems, like guys or supports to resist wind-pressure, are shown in one of the illustrations. In many cases the butt of the tree forms a huge protuberance at the ground-level, taking on a peculiar plastic appearance often seen in the coast districts in *E. maculata* (Spotted Gum), and *Angophora lanceolata* (Smoothed-barked Apple). In *E. coriacea* from this protuberance there spring out as many as four (and even more) stems of equal diameter, such stems being equi-distant from each other, or nearly so.

T *E. Gunnii*, Hook. This species is here inserted doubtfully on Helms authority (see *Agric. Gaz.*, 1893, p. 530). He says: "Near the elevation of 6,000 feet the arborescent growth ceases, and only occasionally small patches of *Eucalyptus Gunnii*, Hook, are met with." If he refers to the growth at the tree-line, a mistake has been made, as the only Eucalypt is *E. coriacea*. *E. Gunnii* was, however, collected at about 5,000 feet.

A smooth-barked tree allied to *Kunzea Muelleri*, Benth., forming masses.

ONAGRARIEÆ.

T *Epilobium confertifolium*, Hook. A dwarf plant included by Mueller in *E. glabellum*.

T *E. glabellum*, Forst. Common along the creeks.

UMBELLIFERÆ.

T *Azorella dichopetala*, Benth. In melting snows.

Azorella Muelleri., Benth. (new for New South Wales); see Maiden and Betche, *Proc. Linn. Soc., N.S.W.* Previously recorded from the summits of the Munyong Mountains, Victoria. Bentham has a note: "This species in many respects approaches *Hydrocotyle* in character as well as in habit." Most persons would, we imagine, collect this for a *Hydrocotyle*. It is the *H. hirta*, R.Br., var. *pusilla*, of p. 736 of my former paper; but I do not say that it is unlikely that that plant may not be found on Mount Kosciusko.

T *Diplaspis* (*Huanaca*) *hydrocotylea*, Hook., f. In melting snows.

Oreomyrrhis pulvinifica, F.v.M. At foot of melting snows; forms a cushion-like mass often with tap-root eight times the depth (1 to 2 in.) of the plant.

Aciphylla glacialis, F.v.M.

T *Oreomyrrhis Andicola*, Endl. Usually in dry clefts of the granite rocks. Very variable in size and habit. Found from Jindabyne to the summit of Mount Kosciusko. A variety has short peduncles and short fruiting pedicels. It differs from the typical form chiefly in these pedicels, which are described as longer than the bracts.

LORANTHACEÆ.

We observed no members of this natural order on any part of Mount Kosciusko.

RUBIACEÆ.

T *Asperula oligantha*, F.v.M.
T *Nertera depressa*, Banks.

COMPOSITÆ.

T *Olearia stellulata*, Labill., both a small-leaved and the normal form. This "Yellow-eyed" *Helichrysum* was most usually sheltered by clumps of *Phebalium ovatifolius*, F.v.M., it forming paler patches amongst the more sombre *Phebalium*.

T *Olearia floribunda*, Benth. A dwarf species forming small masses.

T *Celmisia longifolia*, Cass. The "Large white daisy" with silvery foliage; eagerly eaten by horses.

T *Erigeron pappochroma*, Labill.; also its variety *setosa*, a small rosette-like plant on the banks of the Snowy River.

Brachycome nivalis, F.v.M.

T *B. radicans*, Steetz. In swamps.

B. scapigera, DC. In swamps.

T *B. scapiformis*, DC. *Brachycomes* are pretty little daisy-like plants with white or purple flowers.

Abrotanella nivigena, F.v.M. New for New South Wales. Previously recorded from the summits of the Munyong Mountains, Victoria. This is the only Australian species, the other two being Tasmanian.

T *Craspedia Richea*, Cass. The orange-coloured flowers of this plant and its stouter habit would cause it, at first sight, to be looked upon as a different plant to that so widely diffused in the Colony.

Podolepis longipedata, A. Cunn., var. *robusta*, Maiden and Betche. A handsome plant, characteristic of the higher regions.

T *Leptorrhynchus squamatus*, Less. A comparatively broad-leaved form, uniformly hairy on both sides of the leaf; the peduncle short or absent. Slate Peak, near Mount Twynam (and other localities).

T *Helipterum incanum*, DC.

T *Helichrysum rosmarinifolium*, Less. See page 737 of my former paper.

T *Helichrysum baccharoides*, F.v.M.

T *Raoulia Catipes*, Hook. Forms mats.

Antennaria uniceps, F.v.M. In bogs; also in melting snows.

T *Gnaphalium japonicum*, Thunb., var. *radicans*, F.v.M. This alpine variety bears the unpublished manuscript name of Mueller, given to specimens collected by him in 1855 in the Munyong Mountains, Victoria. Forms small mats. Of similar habit and perhaps general appearance to *Raoulia Catipes*. A beautiful rockery plant.

T *Senecio pectinatus*, DC., var. *pleiocephalus*.

GOODENIACEÆ.

Goodenia hederacea, Sm.

EPACRIDEÆ.

T *Epacris petrophila*, Hook. I have seen a specimen of this species collected by Mueller on the "Australian Alps," in January, 1855.

T *E. mucronulata*, R.Br. Recorded as new for N.S.W. in *Proc. Linn. Soc., N.S.W.*, in March, 1898. *E. mucronulata* is not recorded from Victoria,* perhaps because it was considered by Mueller as a form of *E. paludosa*, but the corolla-tubes are much shorter than the tube, and the bracts and sepals

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* Since this was written Mr. C. Walter has formally recorded the plant from Victoria. (*Vict. Naturalist*, June, 1899, p. 18.)

are rather obtuse. We have *E. mucronulata*, R.Br., from Buffalo Mountains, Victorian Alps, collected by Mr. C. Walter.

T *E. microphylla*, R.Br. This species has considerable range.

T *Leucopogon Hookeri*, Sond.

T *Lissanthe montana*, R.Br. See p. 738 of my former paper.

T *Pentachondra (Trochocarpa) pumila*, R.Br.

T *Richea Gunnii*, Hook., f. Has prickly leaves, blinding sheep temporarily.

BORAGINEÆ.

T *Myosotis australis*, R.Br. Flowers pure white. A smaller and more elegant form than at lower elevations.

SCROPHULARINEÆ.

T *Euphrasia Brownii*, F.v.M.

Veronica densifolia, F.v.M. Forms mats.

LABIATÆ.

T *Prostanthera cuneata*, Benth.

PLANTAGINEÆ.

T *Plantago varia*, R.Br.

T *Plantago Gunnii*, Hook., f.

T *Plantago Brownii*, Campd. F.v.M. (Syn. *P. stellaris*). A glabrous rosetted plant, found near the snow-drifts most commonly.

PARONYCHIACEÆ.

Scleranthus mnaroides, F.v.M. In very exposed places; particularly abundant on Mount Twynam. Forms cushiony masses.

PROTEACEÆ.

T *Grevillea australis*, R.Br. With broader leaves than at lower levels.

G. Miqueliana, F.v.M., was found "above the snow-line" by Rev. J. M. Curran. See my former paper, p. 739. I searched for this handsome species, but could not find it; it must be very local.

Orites lancifolia, F.v.M. It forms dense masses in the shelter of the granite rocks above the tree-line. The highest parts of Mount Kosciusko are poor in number of species of Proteaceous plants, but rich in individuals.

THYMELEÆ.

T *Pimelea ligustrina*, Labill., var. *hypericina*. The involucre in this species is often highly coloured. At the commencement of the journey our guide mildly excited me by assuring me that, high up on the mountain, was a flower "a good deal like a rose." It turned out to be this plant, the flower-heads of which were unusually large and the involucres often red.

Pimelea alpina, F.v.M. Very abundant; prostrate with pleasing pink-white flowers; a gem.

T P. *axiflora*, F.v.M., var. *alpina*. Found at the foot of Mount Mueller and several other places. A neat plant, with a profusion of small white flowers.

T *Drapetes tasmanica*, Hk. This plant may be passed over for a dwarf mass of *Kunzea Muelleri*. It is by no means rare.

CONIFERÆ.

T *Podocarpus alpina*, R.Br. This plant clings to rocks, taking on their shape in a remarkable manner. The fruit (fleshy receptacle) is scarlet; its colour does not appear to have been previously recorded.

ORCHIDEÆ.

Prasophyllum striatum, R.Br. This orchid has a wider range than was hitherto supposed.

LILIACEÆ.

T *Astelia alpina*, R.Br. Forming dense masses at the very edge of snow-drifts.

T *Dianella tasmanica*, Hook. Of the handsome character of this plant I have spoken at p. 1029. It is confined to the scrub of *Eucalyptus coriacea*, at the tree-line, not extending into the plains.

JUNCEÆ.

T *Luzula campestris*, DC. A very dwarf form (1–2″); the inflorescence small in proportion.

RESTIACEÆ.

T *Calostrophus lateriflorus*, Benth. This is the most widely diffused Restiaceous plant on Mt. Kosciusko; it is very abundant.

CYPERACEÆ.

T *Oreobolus pumilio*, R.Br. Forms small tussocks near the melting snow-drifts.

T *Carpha alpina*, R.Br. An almost stemless form. Described in *Fl. Aust.*: "Stems under 6 inches high, in alpine situations, attaining 1 foot when luxuriant. In tussocks near snow-drifts.

T *Carex breviculmis*, R.Br. In the bed of creeks.

T *Carex cæspitosa*, Linn.

Carex canescens, Linn.

Carex cephalotes, F.v.M.

Carex hypandra, F.v.M. In wet turf near foot of Mt. Mueller and other places.

GRAMINEÆ.

Danthonia robusta, F.v.M. "Blady Grass." Occurs also well below the tree-line. An illustration is given of this valuable grass.

T *Danthonia semiannularis*, R.Br., var. *alpina*. (D. penicillata F.v.M. var.) A tough, hard, wiry grass. Often with large ovoid dark-coloured panicles, giving the grass quite an ornamental appearance.

T *Poa cæspitosa*, Forst.

T *Trisetum subspicatum*, Palis.

Agrostis Muelleri, Benth. Two forms; in one the flowering glume has a long dorsal awn; in the other it is without an awn.

Deyeuxia nivalis, Benth. In dry crevices of granite rocks.

LYCOPODINEÆ.

T *Lycopodium varium*, R.Br. Figured in Hooker's *Fl. Tas.* It is a handsome species for cultivation.

T *Lycopodium clavatum*, R.Br.

FILICES.

T *Lomaria alpina*, Spreng. From Jindabyne to near the summit; as also—

T *Aspidium aculeatum*, Sw. These two ferns occur in great profusion.

T *Asplenium flabellifolium*, Cav. In the crevices of rocks; rather rare.

Woodsia lætovirens, Prentice. Found "at the limit of perpetual snow" by W. Baeuerlen.—See Bailey's *Botany Bulletin*, of March, 1891, p. 37.

Summit.

The plants which follow were all gathered on the top of Mount Kosciusko, near the Observatory, or along the gentle slopes surrounding it down to a vertical distance of, say, 200 feet from the summit.

In my former paper, under the list "From 5,500 feet to the summit," I mark certain summit plants with an asterisk. The present list supersedes the former one as far as summit plants are concerned.

Mount Kosciusko Peak is disappointing botanically (it is, however, rich in comparison with Mueller's Peak), and the present list shows the result of my researches, but I do not doubt that extended observations will increase it, though perhaps not to any very great extent. As the area in question is very circumscribed, and there are resident meteorologists at the Observatory, I trust that, in the interests of science, the record of "summit" plants may be completed.

Mount Kosciusko Peak, *i.e.*, the mountain mass which rises a few hundred feet from the valleys which encircle it, is not a very interesting mountain from a botanical point of view. It is a big, rounded hump, grassed to the summit, with comparatively few rocks in the crevices of which plants in variety might effect lodgment, and obtain shelter both from the inclemency of the weather and from the depredations of animals.

Cootapatamba is the name given to the lake on the north side of Mount Kosciusko, at the foot of the peak. Mr. J. F. Mann informs me that the fitting on of this name to this particular lake is the work of the white man. "Kauoola-patamba," the place where the eagle drank, is the aboriginal name for a lake on the Upper Macleay River, and an account of the circumstances under which the name was given will be found in *Proc. Royal Society N.S.W.*, xxiv, 68. It is highly probable that the blacks, who in former times visited the neighbourhood of the lake when searching for "bugongs" (moths), had a name for the lake, but what that name was we do not appear to know.

Mueller's Peak.—This is only about 2 miles from Mount Kosciusko, and is interesting from the fact that it was for a long time considered to be higher than the latter, whereas it is really 78 feet lower. Mount Mueller Peak* consists of a confused jumble of granite boulders, necessitating a scramble to get up. It runs up almost to a point, there being no flat or rounded top, such as Mount Kosciusko has. It is surmounted by a well-built bee-hive cairn, which was the goal of most visitors to Mount Kosciusko. But, by way of compensation, by far the finest views of the Victorian side can be got from Mueller's Peak. The day we went to the summit the atmosphere was not perfectly clear, yet we could see for a surprising distance along the Murray Valley, and our guide pointed out to us well-known points of interest in north-eastern Victoria.

* I need scarcely remind my readers that until recently this was recognised as Mount Kosciusko. Mueller, himself (Clarke's 'Southern Gold-fields,' p. 229), speaks of it as "On Mount Kosciusko, the summit of which consists of granite boulders," &c.

Since the above was in type an interesting letter on this lake, from the pen of Mr. T. B. Notley, Teacher, Public School, Macleay Entrance (Macleay River), has appeared in the *New South Wales Educational Gazette* for 1st August, 1899, p. 58.

Mueller's Peak is a very disappointing mountain from a botanical point of view. Nothing was found on it that did not occur on Mount Kosciusko, and the few plants observed were chiefly grasses, a fern or two—*Cardamine*, *Astelia alpina*—and a few more.

RANUNCULACEÆ.

Ranunculus anemoneus, F.v.M. In clefts of rocks.

T *Ranunculus gunnianus*, Hook. At the edges of the snow-drifts.

PITTOSPOREÆ.

T *Hymenanthera dentata*, R.Br. Broad-leaved form; in clefts of rocks; here a dwarf spinescent shrub.

RUTACEÆ.

Phebalium ovatifolium, F.v.M.

UMBELLIFERÆ.

Aciphylla glacialis, F.v.M. Eaten by sheep and horses, especially the inflorescence and tender centre.

T *Oreomyrrhis Andicola*, Endl. A very dwarf form, with short peduncles, and short fruiting pedicels.

COMPOSITÆ.

T *Raoulia catipes*, Hk.
T *Brachycome scapiformis*, DC.
T *Celmisia longifolia*, Cass.
T *Olearia stellulata*, *Labill.*
T *Craspedia Richea*, Cass.
T *Helipterum incanum*, DC.

EPACRIDEÆ.

T *Richea gunnii*, Hk.
T *Epacris petrophila*, Hk.
T *Epacris microphylla*, R.Br. Very common; its occurrence in this situation is interesting.
T *Lissanthe montana*, F.v.M.
T *Pentachondra* (*Trochocarpa*) *pumila*, R.Br.

SCROPHULARINEÆ.

T *Euphrasia Brownii*, F.v.M.

LABIATÆ.

T *Prostanthera rotundifolia*, R.Br.
T *Prostanthera cuneata*, Benth.

PROTEACEÆ.

T *Grevillea australis*, R.Br.

THYMELEÆ.

Pimelea alpina, F.v.M. A little gem, with a profusion of pretty flesh-pink flowers; here quite prostrate.

CONIFERÆ.

T *Podocarpus alpina*, R.Br.

JUNCEÆ.

T *Luzula campestris*, DC. A very stunted form; very common.

RESTIACEÆ.

T *Calostrophus lateriflorus*, Benth.

CYPERACEÆ.

T *Carex breviculmis*, R.Br. Very dwarf form.

GRAMINEÆ.

Agrostis Muelleri, Benth. A short tufted grass, with dark inflorescence; the flowering glume with a short dorsal awn near the top.

T *Trisetum subspicatum*, Palis.

T *Danthonia pauciflora*, R.Br.

Danthonia robusta, F.v.M.

T *Poa cæspitosa*, Forst. A harsh, wiry form.

FILICES.

T *Aspidium aculeatum*, Sw.

T *Lomaria alpina*, Spreng.

LICHENES.

On the granite rocks, a green lichen and a black foliaceous one.

VII.—General Features of Alpine Plants.

1. *Brilliancy of Flowers.*

A greater brilliancy and size of the flowers has been observed in the European Alps. I do not think that this is specially true in regard to Mount Kosciusko plants, perhaps because of the inferior height of the latter mountain. The increased brilliancy of the flowers would certainly, I think, apply to some species of *Ranunculi,* which are so brightly yellow that one cannot fail to remark it. As will be seen presently, there is not that variety of colour in Mount Kosciusko flowers that obtains in the European Alps.

If we consider the plants I have enumerated from tree-line to 7,000 feet we find the colours of the flowers distributed approximately, as follows:—

White	36
Green and inconspicuous	10
Yellow	13
Dull yellow	6
Purple and pink...	7
Blue	1

(Restiaceæ, Cyperacæ, Gramineæ, &c., have been excluded).

It will be seen that there is an enormous preponderance of white flowers, to which, as regards absence of "colour," the "green and inconspicuous" flowers may be added. The yellow flowers come next in number, and the general impression the flowers give is that of soberness of colour. The purples and pinks are much less numerous, while there is but one blue flower (true it is a gorgeous one), but it is confined to the belt of trees at the tree-line, not extending into the plains, and is not seen by most visitors to Mount Kosciusko.

Blue flowers are, therefore, scarce, while red flowers are absent altogether, being represented by the crimson tints, which pass into purple, there being no scarlets. Some of the pink tints are of portions of inflorescence, which are normally white, or green at lower levels—*e.g.*, the involucres of *Pimelea ligustrina*, the ray florets of *Helipterum incanum*.

How unlike this is to what obtains in the Alps and Europe. Speaking of the Tyrol, Kerner and Oliver, ii, 198, say:— . . . "it will be seen at once that every colour is to be met with here. White and red, yellow and blue, brown and green, stand in varied combination side by side on a hand's breadth of space."

It would be very interesting if an entomologist would report on the insects of Mount Kosciusko with respect to its flora; the comparative absence of highly-coloured flowers might have important bearings upon the distribution of insect life.

2. *Greenness of Foliage.*

An intenser green colour than obtains in similar plants growing in the plains at lower levels is observed in Alpine plants in Europe and elsewhere. I made no special observations on this point, but there seems to me no doubt that the general statements is applicable to the plants of Mount Kosciusko.

3. *Perfumes of Flowers.*

This subject has been referred to by Henslow, p. 116, and by Kerner and Oliver, ii, 198. Henslow says the exhalation of perfumes may, perhaps, perform the same use of arresting the heat as Dr. G. Volkens suggested as being the case in the deserts. Kerner discusses the matter chiefly from the point of view of the attraction of animals by means of scents.

Not many kinds of plants exhale perfumes on Mt. Kosciusko. Excluding the few Rutaceæ and Myrtaceæ found on the mountain above the tree-line, and which only emit an odour on being crushed, the notable perfumes appear to be confined to the genera *Stackhousia* and *Epacris*. It would be interesting, by the way, to go down on one's hands and knees and carefully note down the perfumes of the various plants, most of which are, of course, of diminutive height.

The *Stackhousia pulvinaris* emits a perfume both powerful and sweet. *S. viminea* and *linarifolia* of other parts of the Colony emit a pleasing but far less powerful odour.

The most powerful odour is the strong clove-scent emitted by various species of *Epacris*. So strong is it that it commands attention although the shrubs are dwarf; and, mounted on horseback, one may be raised several feet from the ground. The perfume is owing to the presence of Eugenol (oil of cloves), and Kerner and Oliver give a list of genera (in which, however, *Epacris* does not appear) whose flowers emit this particular odour. My readers will remember that the flowers of *E. obtusifolia*, of the Sydney district, also smell strongly of cloves.

4. *Moss-like growth of plants.*

Then, again, high elevations induce, to use Henslow's words, "a compact habit of growth, sometimes giving a moss-like appearance and furnishing the specific names "muscoides," &c." This may readily be observed in Mt. Kosciusko plants. Take, for instance, *Scleranthus maroides* and *biflorus, Colobanthus, Drapetes tasmanica,* and, perhaps, the whole of the Epacrideæ found on the mountain; and they are very abundant as regards individuals. In all these plants (and others could be mentioned) are small, moss-like or subulate leaves. The presence of an enormous number of mosses (perhaps including many species) should be borne in mind in this connection.

5. *Hummock forms.*

Then plants at high elevations assume hummock forms, or a tufted or cæspitose habit. This is particularly marked in the case of those plants (*Haastia* and others) known as "Vegetable Sheep" in New Zealand. We have no such excellent instances on Mt. Kosciusko, but we have plants which, though smaller, form small cushiony masses, *e.g., Scleranthus* and *Colobanthus.*

The more purely tufted habit is seen in most of the grasses, particularly *Danthonia robusta* and the various species of *Agrostis* and such plants as *Abrotanella nivigena, Astelia alpina.*

Hummocky forms are seen in *Epacris, Kunzea Muelleri, Oxylobium ellipticum, Olearia floribunda, Helichrysum baccharoides,* and speaking generally, in most of those plants which assume a rock-climbing habit.

This rounded shape affords a minimum of resistance to the wind. It also, by its compactness, forms a mass which conducts heat with difficulty; and thus the plant, or congeries of plants, suffers to a minimum extent from great falls of temperature. The concentration of inflorescence which this habit of plants brings about facilitates fertilisation of its flowers.

6. *Dwarfing in size or "Nanism."*

This is very marked with many species. It is most readily observed in the case of a conspicuous plant, such as *Eucalyptus coriacea,* which is found all up the mountain to the tree-line, and is itself normally a tree. At the Jindabyne level it is a tree of medium or even large size. As one ascends one observes its diminishing bulk until it reaches the size of mallee scrub.

Another, though far less prominent, instance is *Podocarpus alpina.* On the Thredbo this is an erect shrub of 5 or 6 feet. Above the tree-line it is a prostrate, clinging shrub of less height and less stem-diameter.

On the summit of Mt. Kosciusko is a form of *Luzula campestris* 1 or 2 inches high; while lower down the mountain the plant assumes its normal height. Other instances are *Ranunculus lappaceus,* which, towards the summit, is represented by a dwarf variety, *Hymenanthera dentata,* which is here so small a shrub that one accustomed to see it

in the warmer coast districts might be pardoned for failing to recognise its Mt. Kosciusko representative; *Oxylobium ellipticum,* dwarfer and more squat than one finds it elsewhere; *Olearia stellulata,* here rarely above 2 feet high; *Plantago varia,* here a much smaller plant; and *Aspidium aculeatum.*

Nanism is attributed to diminishing temperature as a mountain is ascended, winds, and shallowness and poverty of soil—causes which in an ordinary garden are observed to diminish the size of the cultivated objects.

7. *Rock-clinging Plants.*

The rock-clinging habit of many plants in the higher parts of Mt. Kosciusko is so marked as to arrest the attention of the most superficial observer. *Grevillea australis, Podocarpus alpina,* and *Oxylobium ellipticum,* var. *alpinum,* display this rock-clinging habit in a very marked manner. Scarcely inferior examples are *Phebalium ovatifolium, Kunzea Muelleri, Pentachondra pumila, Orites lancifolia,* and *Drapetes tasmanica.*

The rock-clinging habit is probably induced by a combination of circumstances, the principal of which is doubtless the strong winds that prevail at high altitudes.

A plant begins existence sheltered in a cleft of a rock or around the edge of the rock-mass. As it grows it gradually emerges from its shelter, and the growing and plastic branchlets, blown by the fierce wind, are forced against the solid rock, which the plant gradually embraces as affording least resistance to the blasts. The weight of snow doubtless accentuates this clinging, but is probably of quite secondary importance in bringing about the result. I arrived at this conclusion when I ascertained that long ago Kerner (see Kerner and Oliver, I, 524) had made a similar pronouncement in regard to the effects of snow under such circumstances.

At the same time Kerner (*op. cit.*, p. 525) attributes the clinging of woody plants to the ground in high altitudes to the fact that in the high Alps the ground is relatively much warmer than the air, and that plants lying on the soil profit by this higher temperature. The utterances of an authority like Kerner command the highest respect, but I will not alter what I have written, as I desire rather to draw attention to the subject rather than to obtrude any dogmatic statements of my own. Again, I was referring more particularly to the rock-climbing habit of plants on absolutely bare rocks, just as we see them on Mt. Kosciusko, and these bare rocks, which are fair conductors of heat, and uncovered with a non-conducting layer of soil or humus, as perhaps referred to by Kerner, may have a temperature more nearly approximating that of the external air than is the case with the soil contemplated by that authority.

Our plate shows the rock-clinging habit of *Podocarpus alpina* on granite, taken at about the tree-line.

There is a figure of dwarf and prostrate plants in Kerner and Oliver, I, 524.

8. *Mat-forming Plants.*

Perhaps, however, the facts marshalled by Kerner apply more particularly to what I may describe as "mat-forming plants," *i.e.*, those plants which form matted growths fairly uniform in appearance. Such plants are usually shallow rooters, so that if one dislodges the outside portion of a plant-mat, the congeries of plants may be removed from the ground without difficulty. These mat-forming plants form quite a feature in the high mountain vegetation of Kosciusko. Following are most of the species affecting this habit of growth:—*Claytonia australasica, Stackhousia pulvinaris, Epilobium confertifolium, Nertera depressa, Raoulia Catipes, Gnaphalium japonicum*, var. *radicans, Goodenia hederacea*, var., *Pentachondra pumila, Pimelea alpina*. This matted growth must form a non-conducting material which will prevent too rapid a dissipation of the earth-heat in the vicinity of the plant. Some of these mat-forming plants display a tendency towards a rock-clinging habit—in fact, there is no hard-and-fast line of demarcation between them and rock-climbers.

9. *Rosettes of Leaves*

Are common in Alpine plants, and this disposition of foliage, the result of contraction of the stem, to some extent springs from a similar cause to that which obtains in the case of rock-clinging, or rather, mat-plants. Instances of rosetted plants on Mt. Kosciusko are not many. They include *Plantago Brownii* (*stellaris*), *Erigeron pappochroma*. (At lower elevations the stem asserts itself.) The shortening of the stem in *Helipterum incanum* is very marked, although the leaves cannot be said to assume a rosetted appearance. Under *Carpha alpina* it will be seen that this species assumes a stemless form on Mt. Kosciusko which does not appear to be recorded from any other part of the Colony.

The subject of rosetted leaves is discussed by Kerner and Oliver, I, 410, and Henslow, p. 101.

10. *Long Tap-roots.*

It was observed that some plants on Mt. Kosciusko possess long tap-roots. This seemed to be particularly the case with certain small plants found near the permanent snow-drifts, *e.g.*, *Caltha introloba, Plantago Brownii*, and *Umbellifers* in particular, *e.g.*, *Oreomyrrhis pulvinifica, Aciphylla glacialis*, &c., and *Pimelea axiflora*, var. *alpina*. Speaking generally, the more succulent plants have longer tap-roots than at lower elevations. A ready test of this lies in the fact that so many of them are required to be carefully dug up by the trowel for herbarium specimens. I allude to such plants as *Ranunculus, Cardamine, Brachycome* and *Senecio, Drosera Arcturi*.

With the long tap-roots of desert plants we are familiar, but prominence does not appear to have been given to the long roots of Alpine plants. In the case of the Mt. Kosciusko plants, it is undoubtedly a case of "hydrotropism"—a search of the roots after water. In the higher parts there appears to be usually water on the surface of the granite rock, and the roots penetrate the superincumbent soil or gravelly pebbles in search of it.

11. *Pilosism or hairiness.*

This is a frequently observed character of Alpine plants, and it was well marked on Mt. Kosciusko. This is especially the case with many Compositæ. The woolly-hairiness of *Podolepis longipedata*, A. Cunn., var. *robusta*, was referred to in my former paper (p. 737), and is very striking.

Helipterum incanum becomes increasingly hairy, and on the summit many plants look as if they had been fashioned out of flannel. *Olearia stellulata* is densely beset with stellate hairs; *Celmisia longifolia* is silky hairy; *Erigeron pappochroma* is hairy, and its variety, *setosa*, more so. *Craspedia Richea* has a felted appearance, while the variety of *Leptorrhynchus squamatus*, found in the higher regions, is far more hairy than that found in any other part of the Colony. *Raoulia Catipes* is often called "Australian Edelweiss," so strongly does it remind one of its woolly European namesake. *Gnaphalium japonicum*, var. *radicans*, also belongs to the Edelweiss type. So much for the woolly Composites. *Ranunculus anemoneus* and *Gunnianus* are much more hairy than the other Mt. Kosciusko species. This seems readily accounted for by the drier situations they prefer. *Oreomyrrhis Andicola* is the *Umbellifer* which frequents the driest situations (rock-shelters); it is also the hairiest. These seem to be the most noticeable of the hairy plants.

The need of hairy coverings on the leaves of Alpine plants is dwelt upon in Kerner and Oliver, I, 315, as a means of lessening transpiration. "If no showers fall for several successive days, and the wind blows over the heights with a clear sky day and night, the scanty layers of soil may dry up to such an extent that they are unable to supply the necessary fluid food to the plants rooted in them." Hence the pressing need of checking transpiration.

On the contrary, the plants which live in situations which are incessantly wet, *e.g.*, at the lower fringe of a snow-drift, or in the bed of the incipient creek arising therefrom, do not require hairs, and are nearly or quite glabrous; *Caltha introloba*, *Ranunculus Millani* and *Gunnianus*, *Plantago Brownii*, *Oreobolus pumilio* will at once occur to one in this connection. Those who desire to consider the matter further may be invited to consult Henslow, *op. cit.*, p.p. 110, 111.

The protective value of dense hairiness against the depredations of grazing animals may be referred to by the way.

12. *Spinescence*

Is a character of shrubs found at high altitudes, but it does not appear to be very marked at Mount Kosciusko. *Hymenanthera dentata* is the only shrub markedly spinescent which occurs at the highest points. The branches, owing to the severe conditions of existence of the plant, are transformed into spines, and in this condition present resistance to the attacks of herbivorous animals. Speaking of defensive arrangements as regards animals, it may be mentioned that

the sharp leaves of *Richea Gunnii*, so abundant on the highest plains, frequently enter the eyes of sheep, causing temporary and even permanent blindness.

13. *Succulence.*

A certain degree of succulency in the tissues has been observed in Alpine plants, and this may be observed in some found on Mount Kosciusko.

Take, for example, *Eucalyptus coriacea*, which attains its greatest luxuriance in the coldest districts of the Colony. The unusual succulence of its foliage is appreciated by large stock, hence the name "Cattle-gum" that is often applied to it. On Mount Kosciusko the leaves become increasingly succulent as higher regions are reached, and I think the reason why horses do not appear to eat it is because of the excellent and nutritious grasses to be found on the mountain.

The case of *E. coriacea* is a notable instance of the decreasing size, increased succulence, and glaucousness of the leaves as higher elevations are reached. At the tree-line the leaves are thick, leathery, highly glossy and small, with very glaucous twigs, fruits, &c. As the mountain is descended all these characters are modified.

Plantago Brownii (*stellaris*) found near the snow-drifts is a very succulent plant, while *Podolepis longipedata*, var. *robusta*, is, at the level of, say 5,500 feet, so succulent, that this character, conjoined with the shape of the leaves, caused me to compare it to lettuce. At lower levels the plant would never be called succulent.

Other plants of a succulent character are the various *Ranunculaceæ*, the *Brachycomes*, *Senecio pectinatus*, *Celmisia longifolia*, and perhaps one or two other Composites—*Aciphylla glacialis* and *Astelia alpina*.

Succulence is, of course, the result of taking up a large quantity of water. This enables plants (as we well know in Australia) to more readily withstand the effects of extremes of temperature and of drought.

14. *Brief Life-history of Plants.*

In high latitudes, or at high altitudes, it is a matter of common observation that a plant runs its course very rapidly. During the very brief summer it has to form leaves, develop inflorescence, and mature fruit. On the highest parts of Mt. Kosciusko flowers begin to appear about the end of November, as the snows melt, and winter sets in in earnest by the end of March.

15. *Perennial Habit of Growth.*

In the highest part of the European Alps there are no annuals (Bonnier and Flahault, quoted by Henslow, 116). "Moreover, species which are ordinarily annuals at low levels, if growing at high elevations are found to have become perennials."

Without going so far as to say that there are no annuals growing in the upper regions of Mt. Kosciusko, I do not call to mind any plants from the tree-line upwards that are not perennials.

VIII.—Brief Remarks on Fungi, Mosses, &c.

Fungi are remarkably scarce on Mt. Kosciusko. I searched carefully for them, and the only one I observed was a micro-fungus on *Caltha introloba*, F.v.M. It forms the subject of a paper, "A Mount Kosciusko Micro-fungus," by Mr. D. McAlpine, of Melbourne, in the *Proceedings of the Linnean Society of N.S.W.* for the current year. He has determined it as *Puccinia calthæ*, Linn., and makes the following observations:—"There is a special interest attaching to this fungus, from its geographical distribution. The host-plant was found in a rocky creek on the eastern side of Mueller Peak, Mt. Kosciusko, at a height of about 6,500 feet. This was the only micro-fungus found there by Mr. Maiden, and at that season of the year (January) only the Æcidium stage occurred. This is the first record of the fungus in Australia, and it occurs also in Europe and America. Hitherto it has only been found on the Marsh Marigold (*Caltha palustris*, Linn.)"

The fungus was rather plentiful in this particular creek, but, like most of the collecting on Mt. Kosciusko, it had to be searched for on hands and knees.

Mosses.—The moss-flora is certainly interesting, consisting of an enormous number of individuals, and probably of a large number of species. My assistant, Mr. William Forsyth, made a fine collection of these plants, which are now being determined.

One is struck with the paucity of the species of the characteristic Australian genera *Acacia* and *Eucalyptus* on Mt. Kosciusko.

After about 5,000 feet we have only one species of *Eucalyptus*, viz., *E. coriacea*, which is, however, very abundant as regards individuals until the tree-line is reached.

As regards *Acacia*, I failed to find any at Pretty Point or higher; while from the Sawpit Creek level they are very few, both in numbers and individuals.

IX.—Some Gems of the Mt. Kosciusko Flora.

Mt. Kosciusko does not boast what may be called showy flowers, but so many of them have a beauty and a sweetness all their own that it does not seem far-fetched to call them gems. Their beauty grows upon one as one studies them. They are neither garish nor coarse, if such expressions can be used in regard to any member of the vegetable kingdom.

Mount Kosciusko may, in a sense, be said to begin at the Snowy River Valley on the one side, 30 miles from the summit, and, as regards lateral extension, the range of which it forms the most notable peak extends over a considerable area. This large mountain mass has a considerable flora, as I have shown, and I cannot do more than touch upon a few of the plants. It becomes sometimes difficult to make a selection, but if I have erred, it is in the direction of omissions rather than the reverse.

Dianella tasmanica I have already alluded to, and several of the mat-forming species may truly be called gems, and are specially promising for horticultural purposes. Following are most of the species affecting this habit of growth:—*Claytonia australasica,* bearing beautiful white flowers; *Stackhousia pulvinaris,* the perfume-plant already alluded to; *Epilobium confertifolium,* a beautiful glaucous-leaved plant, bearing a profusion of creamy-white flowers; *Nertera depressa,* the dainty little plant with a profusion of reddish berries (it has long been in cultivation in Europe, and is well known to all of you); *Raoulia Catipes,* the Australian Edelweiss, one of the daintiest of the Alpine flora, and quite as beautiful, in my opinion, as its European namesake; *Gnaphalium japonicum,* variety *radicans,* a composite plant allied to the preceding; a dainty variety of *Goodenia hederacea,* with white undersides to the leaves; *Pentachondra pumila,* a sweet little plant belonging to the *Epacris* family; and *Pimelea alpina,* a dainty little flesh-tinted flowering plant which likes to conceal itself in fissures, and under shelves of rocks. I would that I could have referred to these by homely common names, but as the vast majority of Mount Kosciusko plants do not possess such appellations, I am forced to fall back on the scientific ones.

And now I may refer to some other plants, all beautiful in their way. The ferns are few in number, less than half a dozen altogether. They include *Lomaria alpina,* which is found right up the mountain, and also *Aspidium aculeatum,* which is so common that one sometimes loses sight of its beauty. Then Mount Kosciusko plateau is the place for buttercups (*Ranunculus*). The largest is a white-flowering species (*R. anemoneus*), the flower 2 or 3 inches in diameter, while the smallest is *R. Millani,* a dainty little species often less than an inch high, and present in innumerable quantities. I have already sufficiently alluded to this genus. The sight of the dwarf and spotlessly white *Caltha introloba,* growing on the fringe of the snow-drift, or actually under the snow is very beautiful, and it would be admitted into the most select company of Alpine plants, but one must hurry on. *Brachycome* is the name given to certain daisies, white and purple, which grow in profusion on the mountain, and all of them are worthy of cultivation. The *Olearias* or daisy-bushes are hardly less beautiful, while *Helichrysum rosmarinifolium* in its various forms might also be called snow-ball bush, in such profusion does it bear its trusses of white flowers. Then *Helipterum incanum* is a little beauty, particularly dwarf on the mountain, and looking for all the world as though it had been snipped out of white flannel. *Craspedia Richea,* the well-known Bachelor's Buttons of grass lands of the Colony, has usually a yellow flower, but on Mount Kosciusko this is changed to orange. *Podolepis longipedata,* variety *robusta,* has a long name; but then it is a large plant, bearing a profusion of yellow flowers, and large, very flannel-looking leaves.

The Mountain Celery of these regions, *Aciphylla glacialis,* is very abundant, and bears a profusion of white flowers in the grass-land. Then we have two plants with longish, silvery leaves—one a pretty white daisy, and known as *Celmisia longifolia*; the other is a Liliaceous plant, and is known as *Astelia alpina.* It grows at the fringe of the

permanent snows. The purple *Euphrasias* or Eyebrights, are both abundant and beautiful, while at lower levels *Veronicas* of two or three species adorn rock masses with a profusion of blossoms of the same colour. *Epacris* is represented by several species and by an enormous number of individuals. I have alluded to this typical Australian genus already. *Prostanthera* is represented by two or three free-flowering shrubs bearing purplish blooms, while it may be news to many that we have an Australian Gentian (*Gentiana saxosa*) with pale purplish flowers, and known to residents of the mountain by the name of " Snowdrop." There are no epiphytal orchids, and only very few terrestrial ones. I would like to enumerate these, and also to dwell upon other plants which I have had regretfully to omit from this little summary for lack of space. Many of the plants to which I have referred are not yet in cultivation; but although it would be difficult to deal with them in the climatic conditions of Sydney, many rockeries and other places in gardens in the colder parts of the Colony remain, in the near future, I trust, to be adorned with some of the gems of the Mt. Kosciusko flora.

Identity of the Mt. Kosciusko and Tasmanian Flora.

It has already been observed that the Mt. Kosciusko fauna has much in common with that of Tasmania. This points to a former land-connection between the two districts. The flora of Mt. Kosciusko contains a large percentage of plants which are also found in Tasmania. This was first clearly pointed out by Lhotsky, and amply proved by Mueller. Many of them are found in other colonies as well. I have placed the letter T before all species that are also found in Tasmania. In many cases not only are the species identical, but the very forms.

Of 28 plants enumerated as occurring on the summit of Mt. Kosciusko, no less than 27 are Tasmanian.

As the list of Jindabyne and Sawpit Creek plants enumerated in the present paper does not take cognizance of those given in my former paper, the two lists must be considered in estimating the percentages of Tasmanian species at those two levels.

We may present our results in the form of a table:—

Plants found at	Number of species.	Number of Tasmanian ones.	Pencentage of Tasmanian species.
Summit	28	27	96
Tree-line to 7,000 feet	105	75	71
Pretty Point	70	61	87
Thredbo	55	46	84
Sawpit Creek	63	44	70
Jindabyne*	78	60	77

* No attempt was made to make a complete collection of Jindabyne plants.

So abundant, in fact, are the species common to Tasmania and Mt. Kosciusko, that a handbook of the Tasmanian flora would be very useful to the student of Mt. Kosciusko plants, and study of it might lead to the recognition of plants not yet found on the mountain in question.

A few of the characteristic genera of Mount Kosciusko are to be found in cold Kerguelen Island, *e.g.*, *Lomaria alpina*, Spreng. (found in nearly all the islands of the Southern Ocean); *Nertera depressa*, found "all round the south-temperate zone"; the wide-spread *Acæna sanguisorbæ*, and *Limosella aquatica*, Linn.; *Drapetes* and *Azorella*; but the affinities are strongly and undoubtedly with Tasmania.

The question of the distribution of many New South Wales plants is of intense interest, but space does not allow full discussion of the matter at the present time. Numbers of plants will readily occur to one as widely distributed over Eastern Australia (often including Tasmania), which, as far as New South Wales is concerned, are often found in widely separated localities, because the intervening country is greatly inferior in height.

Speaking of Europe, Henslow, "Origin of Plant Structures," states, p. 90:—"Several Arctic and Alpine plants are identically the same species, and the latter are believed by many botanists to have survived on the summits of more southern mountains of Europe, since their dispersal from the higher latitudes after the close of the Glacial Epoch."

In connection with this subject of plant distribution, the following lists will be found interesting. They were furnished by Mueller, and incorporated in Clarke's "Southern Gold-fields," published in 1861.

It will be observed, by comparison with the foregoing lists, that all Mueller's plants are not Mount Kosciusko ones. Some are hitherto only recorded from Victoria, and are marked with an asterisk. A few will probably be found by assiduous collectors on Mount Kosciusko.

Where the name given no longer stands, the recognised name at the present time is given in brackets.

In this connection, Mueller's Annual Report for the year 1854 (referred to at p. 726 of my former paper), should be referred to, as it contains the list of plants collected by him in the Australian Alps (except, perhaps, a few that had not been worked out at the time of writing the report), which list formed the basis of that published by Clarke. In Mueller's Report, the "Muniong Ranges" plants are not differentiated from those found in other parts of the Colony during the same year; so that it requires some care to pick them out.

His five papers, read in 1854 and 1855 before the Philosophical Society of Victoria, and the Victorian Institute, referred to above will be found specially useful in studying these lists.

Mueller's "Plants Indigenous to the Colony of Victoria," vol. i, Thalamiflorae (1860–62), and its supplementary volume of Lithograms (1864–5), contains much information and several illustrations of plants found on Mount Kosciusko, p. 232.

1. Alpine Plants common to Australia and Tasmania, exclusive of those of the lowlands ascending to Alpine summits :—

Ranunculus Gunnianus, Hk.
Celmisia longifolia, Cass.
Gentiana Diemensis (*saxosa*), Forst.
Podocarpus alpina, R.Br.
Trisetum subspicatum, Palis.
Hicrochloe antarctica (*redolens*), R.Br.
,, *submutica* (*redolens*, var. ? *submutica*). (Many of the authors' names were omitted in the original.)
**Agrostis contracta* (*Deyeuxia scabra*).
**Geranium brevicaule* (*sessiliflorum*). We have it from Kiandra, but not from Mount Kosciusko).
Hovea purpurea (*longifolia*, var. *lanceolata*).
Didiscus humilis, Benth.
Ozothamnus Hookeri (*Helichrysum baccharoides*).
,, *cinereus* (*Helichrysum cinereum*).
Antennaria nubigena.
Senecio pectinatus, DC.
Gaultheria hispida, R.Br.
Leucopogon Hookeri, Sond.
* ,, *Frazeri*, A. Cunn.
Richea Gunnii, Hk.
Prostanthera rotundifolia, R.Br.
Euphrasia alpina, R.Br.
Grevillea australis, R.Br.
Exocarpus humifusa (*nana*), R.Br.
Juncus falcatus, E. Mey.
Oreobolus pumilio, R.Br.
Lomaria alpina, Spreng.
Caltha introloba, F.v.M. On gravelly snow-wet places on Hotham, Latrobe, and the Muniong Ranges.
Drosera Arcturi, Hook.
Stackhousia pulvinaris, F.v.M.—Highest summits of the Alps, 5,000–7,000 feet. Fragrant starry flowers.
Acacia Stuartiana (*siculiformis*), Cunn.
Dichopetalum ranunculaceum (*Azorella dichopetata*).—On wet gravelly places, Munyong Mountains, 5,000–6,000 feet.
Diplaspis hydrocotylea, Benth. & Hk.
Coprosma pumila, Hk.
Erigeron pappochroma, Labill.
**Velleja montana*, Hook.
Pentachondra pumila, R.Br.
Epacris microphylla, R.Br.
Veronica nivea, Lindl.
Drapetes tasmanica, Hook.
Astelia alpina, R.Br.
**Herpolirion tasmaniæ* (*novæ-zelandiæ*).

2. Exclusively Australian Alpine plants :—

**Eriostemon alpinus*, F.v.M. (*Phebalium squamulosum*, var. *alpinum*).
* ,, *ozothamnoides*, F.v.M. (*Phebalium ozothamnoides*).
,, *ovatifolius*, F.v.M. (*Phebalium ovatifolium*).
* ,, *trymalioides*, F.v.M. (*Asterolasia trymalioides*).
Oxylobium alpestre, F.v.M.—Higher parts of the Alps.
Bossiæa distichoclada (*foliosa*), Cunn.—From the Mitta Mitta to the Snowy River; never below 4,000 feet.
Gingidium glaciale, F.v.M. (*Aciphylla glacialis*).—Not rare; 5,000–7,000 feet.
Gingidium simplicifolium, F.v.M. (*Aciphylla simplicifolia*).—Sub-Alpine; Mt. Wellington to the Munions, otherwise Mounong or Munyang—a name derived from a grass so called by the aborigines.
Eurybia megalophylla (*Olearia*), F.v.M.
,, *alpicola* (*Olearia*), F.v.M.
Ranunculus anemoneus, F.v.M.—Next to *Grevillea victoriæ*, the greatest ornament to the Snowy Mountains.

Ranunculus Millani.—On Mt. Wellington.
**Capsella blennodina* (*Blennodia alpestris*).
Boronia algida, F.v.M.—Mts. Hotham, Latrobe, and Kosciusko. I have not yet found this plant on Mt. Kosciusko. (J.H.M.)
Kunzea ericifolia, Reichb. (*Muelleri*).—Highest part of the Muniongs, and thence to Mt. Wellington.
Pozoa fragosia (*Azorella Muelleri*).—Rare. On the highest shady tops of Muniong Range, 6,000 feet.
**Seseli Harveyanum*, F.v.M.—Cobberas to Muniongs; 4,000 to 5,000 feet.
* ,, *algens*, F.v.M.—Muniongs; 5,000 to 6,000 feet.
Trineuron nivigenum, F.v.M. (*Abrotanella nivigena*).—Near melting snow; Muniongs, 5,000 to 6,000 feet.
Antennaria uniceps.—Springs and flooded parts; Muniongs, 5,000 to 6,000 feet.
**Leucopogon Macraei*, F.v.M.—Sources of Mitta Mitta; Mts. Hotham and Latrobe; Cobberas, 5,000 to 6,000 feet.
**Decaspora Clarkei*, F.v.M. (*Trochocarpa Clarkei*).—Shady ravines, Mt. Wellington. This plant resembles *T. pumila* a good deal, and may be expected to be found on Mt. Kosciusko. (J.H.M.)
Euphrasia alsa (*antarctica*), Benth.—Highest stony summits of Muniong, 6,000 feet.
Pæderota densifolia (*Veronica densifolia*), F.v.M.—Highest stony summits of Muniong, 6,000–6,500 feet.
Grevillea victoriæ, F.v.M. (identical with *G. Miqueliana*).—Summits of Mts. Buller, Tambo, Hotham, and Latrobe; sources of Mitta Mitta.
Orites lancifolia.—Muniongs, 5,000 to 6,000 feet.
Astelia psychrocharis (*alpina*).—Mossy sources of Hume and Snowy Rivers.
Oreobolus distichus (*pumilio*).—In mosses; highest summits of Alps.
Carpha nivicola (*alpina*).—Near swamps; highest summits.
Scleranthus mnarioides.
Bossiæa foliolosa (*foliosa*, see above).
Oschatzia cuneifolia (*Azorella cuneifolia*).
Andræa australis, F.v.M. (Mitten).—A moss.
Carex cephalotes.—Muniongs; highest springs.

3. A few of the Alpine plants are identical with European species. For instance—

Alchemilla vulgaris.
Veronica serpillifolia.
Sagina procumbens.
Carex pyrenaica.
,, *echinata.*
,, *canescens.*
,, *Buxbaumii.*
Lycopodium selago.
Botrychium Lunaria.
Turritis glabra (*Arabis glabra*).

4. Very few are the same as New Zealand species, unless they are also found to be represented in Tasmania. One of the most remarkable amongst them is—

Veronica tetragona. (This is a slip of the pen, this species not being Australian. *V. plebeja*, a small species, is the only one common to Australia and New Zealand.)

5. Plants found on the Alps, chiefly on the Victorian side of the boundary, collected from Dr. Mueller's Memoirs in the *Trans. Vict. Inst. and Phil. Soc.*, 1854 and 1855.

Brachycome nivalis.—Cobberas and other high summits of the Alps.
Westringia senifolia.—Summit of Mount Bullen.
Phebalium ovatifolium.—Sources of Hume and Snowy Rivers.
Eriostemon trachyphyllus.—Mountains near the Pinch Range.
Blennodia alpestis.—Sources of Hume and Snowy Rivers. Sub-Alpine.
Pozoa cuneifolia (*Azorella cuneifolia*).—Mount Wellington, Cobberas, &c., in turf moss, 5,000 feet.
Erigeron conyzoides.—Sources of Hume and Snowy Rivers, 4,000–5,000 feet.
Scirpus polystachys.—Mount Leinster, Omeo, Buumba, Snowy River.
Carex polyantha.—Valleys of Upper Mitta Mitta.

My travelling companions were Mr. J. J. Fletcher, M.A., B. Sc., Secretary of the Linnean Society; Mr. A. H. S. Lucas, M.A., B.Sc., of the Grammar School; and Mr. William Forsyth, of the Centennial Park. These gentlemen assisted the object of our trip in every possible way, placing their botanical specimens freely at my disposal, and assisting me with their valued opinions and advice at every stage of the journey. The photographs from which the illustrations were prepared were taken by Mr. Wm. Forsyth, who took a large number of photographs depicting the vegetation and topography of the mountain. Our guides were Messrs. Fred. Collins, of Jindabyne, father and son. They were most painstaking, and I unhesitatingly recommend them to intending visitors to Mount Kosciusko.

REFERENCE TO PLATE.

No. 1. View of part of Alpine lake with foreground, showing the shrubby vegetation closely appressed to the rock-surfaces.

No. 2. Clump of snow gums (*Eucalyptus coriacea*) forming the limit of tree vegetation.

No. 3. Permanent snow-drifts, the home of *Ranunculi*, *Caltha introloba*, &c., with "ribbony or blady grass" (*Danthonia robusta*) in the foreground.

No. 4. General view of the plains near the summit of the mountain, showing granite masses and tufted vegetation partly covered with snow.

FARMING IN NEW ENGLAND.

THE farmers in the New England district, writes Mr. Franklin Jacks, of Armidale, have, thanks to the late welcome rains, been busily engaged preparing every available acre for crop; and the advent of much new modern agricultural machinery, more especially the rotary disc plough, to the district is worthy of special notice. The progressive farmer is ever ready to seize upon new ideas and to try them, and, as a consequence, many of the old thought-to-be-worn-out farms are receiving a turning over and a taste of modern yeomanry that fairly surprises them. There is one thing, however, that the New England farmer will have to do, and that is to compel his next-door neighbour to destroy the Boggabri, Bathurst burr, sweet-briar, blackberry, and Scotch thistle, while he himself assists his land to produce his crops by liberally allowing it a fair quota of good manure, thus returning good for good, and, as "a fair exchange is no robbery," perhaps the ground may give him back in return the best of the bargain. Instead of throwing manure over the back fence put it on the land—plough it in; throw the weeds over the back fence instead.

THE NOOGOORA OR COCKLE BURR.
Xanthium strumarium, Linn.

The Noogoora-burr, or Cockle-burr.

In his article on the North Coast District, which appeared in the *Agricultural Gazette* for July last, the Hon. the Minister for Agriculture drew attention to the manner in which the Noogoora-burr is spreading throughout that portion of the Colony, and directed that the fullest particulars concerning this pest, and the most effective means of eradicating it, should be published.

In the *Agricultural Gazette*, Vol. VII., Part 7, July, 1896, Mr. J. H. Maiden, Government Botanist, had an article on this weed under the vernacular "Cockle Burr," and described it as "a serious weed pest which threatens the Colony." For the information of those who have not read Mr. Maiden's advice (it must be borne in mind that since 1897 nearly 2,000 new readers have been added to the list), the article is reproduced, together with several reports which have been obtained at the instance of Mr. Alex. Bruce, Chief Inspector of Stock.

The Cockle-Burr (*Xanthium strumarium*, Linn.): A serious Weed Pest which threatens the Colony.

J. H. MAIDEN,
Government Botanist, and Director of the Botanic Gardens, Sydney.

If a ship brings small-pox to our shores, the most stringent quarantine regulations are put in force, and the disease is forthwith stamped out; if a suspicious case arises inland, a medical man of much experience is despatched to the district, and the matter is inquired into on the spot at once; but I am sorry to say that as regards weed, fungus, and insect pests, which war against the tiller of the soil or the pastoralist, we have no such ready method of treatment. In the first place, we usually hear of the spread of an unknown weed from some chance correspondent, and then, when it gets so bad that something must be done, the time for arresting its spread has passed. I was talking to Mr. F. M. Bailey, the Government Botanist of Queensland, a few days ago (this was written in 1896) about the pest which forms the subject of this article. He said, "I well remember when £50 would have stamped it out in my Colony; now it would take untold wealth to do it."

I am not in a position to state all the infected areas in New South Wales (perhaps correspondents will tell me). I suppose less than £1,000, judiciously spent, would entirely free us from the pest at the present time. I have no desire to be sensational, but I state that, if allowed to spread unchecked, it will, in a few years, deteriorate our territory to the value of a million of money. If we had a Weed Act

in force we might have the machinery available to cope with the threatened danger.

Vernacular Names.—It is called "Noogoora" burr in parts of Queensland, owing to its prevalence in that locality; the name is, however, scarcely suitable in New South Wales. In the United States it goes by the name of Clot-burr or Cockle-burr. I suggest adoption of the latter name in this Colony.

Botanical Name.—*Xanthium* (already explained) *strumarium*, from the Latin *struma*, a swelling, in allusion to the shape of the fruit.

Reports from New South Wales in regard to it.—It has been recorded from New South Wales for at least seven years. Following are two recent reports concerning it:—

Mr. A. H. Hammond, of Rose Vale, Byron Bay, writes under date 21st April, 1896:—"I am forwarding a specimen of noxious weed which we would like to know the name of. It has been brought here only recently, but bids fair (as you will see by the seed) to spread far and wide in a very short time. This specimen is the top of a plant 6 feet high, and the limbs at the base are about 5 feet across. It grows very much like the castor-oil plant when young. It is at present growing on the side of a road, and if a noxious weed, I think the maintenance man on that portion of the road should be instructed to keep it brushed down."

On the 15th April, 1896, Mr. Forester Pope wrote from Burringbar, Tweed River:—"I forward specimen of a burr which has recently made its appearance in this district, and which, I fear, is likely to become a severe pest if not checked in time. It is my belief that it was originally brought here by men who brought horses from Queensland to work on the railway. Mr. W. M. Charles, of 'Warrana," Tweed River, says it is the 'Narcoora' (Noogoora) burr, and that he has seen whole paddocks destroyed by it. He also says that the seeds will germinate after lying two years in the ground. The plant grows to a height of 5 feet from the ground, with spreading branches, covering a space 5 or 6 feet in diameter. The burrs when ripe are light and easily catch in horses' manes and tails, from which they are only removed with great difficulty. It is confined chiefly at present to the Tweed district. I have seen very little of it on the Richmond, but I am quite sure from what I have seen of it myself that, unless it is checked, the consequences will be most serious. I have not noticed that anything will eat the leaves. It dies in the winter, but comes up again stronger than ever in the spring.

Mr. G. H. Gordon, Chairman of the Warialda Sheep and Pastures Board, writing to Mr. Bruce about the spreading of the burr in that district, says:—"During the week ending Sunday, 9th July, 1898, I visited with Mr. Kirkpatrick, I.S., the country about Boggabilla, thence to Goondiwindi, at his request and in compliance with your wish to him, and now advise that the Noogoora-burr has for this season advanced to a stage when it would be useless in expending money in cutting it. All that can be done, *pro tem.*, is to thresh it out about the Goondiwindi Bridge and Boggabilla Common Crossing of the river, at a cost not to exceed from £10 to £15. By so doing a certain

amount would not be carried away by stock and distributed through the country; but unless the same thing is done by the Queensland Government, on the other side of the river, the expenditure would be of very little use. The balance of money available now should be utilised when the burr is fit to cut next season, and this amount it will be necessary to largely supplement if the pest is to be coped with. I regret to say that both sheep and cattle have already largely distributed it all over this north-western portion of the Colony, and I feel sure that unless legislation to cut both the Bathurst and Noogoora-burr is at once brought about, the loss sustained by the Colony will be enormous. It is apparent that all commons and stock routes are the growers and distributors of the pests. The Noogoora-burr comes down from Queensland waters, and unless the Queensland Government at once takes the matter in hand with New South Wales, it will be useless New South Wales expecting to do any permanent good by cutting, unless by a large annual expenditure."

Mr. Stock Inspector Kirkpatrick adds, in reference to Mr. Gordon's communication:—"I agree with Mr. Gordon's recommendations, but would suggest that a few pounds—say, £5 or £10—be spent on either cutting or threshing at the plants near to where travelling stock are likely to come in contact with them, and so prevent the seed from being distributed along the stock routes." This, of course, will be done. In Queensland, the pest has, unfortunately, become well established, and the Department is indebted to the Honorable the Minister for Agriculture in Queensland for the following report upon it:—"The Colonial Botanist, Mr. F. M. Bailey, the author of the article, has received no reports that it can be generally met with in the north, but it has overrun many parts of South Queensland, especially on the coast side of the Main Range, the main cause of distribution, in his opinion, being attributable rather to the dissemination of the burrs by means of stock, to which they stick, than by flood waters, though, of course, the latter have done their part. No systematic attack has yet been made upon this pest, the cost of which would be very great; but, under the powers of the Divisional Boards Act of 1887, clause 177, some Boards have attacked the pest within their boundaries. In such divisions where there are unoccupied Crown lands and reserves for the condition of which the Crown is liable, the course usually followed is for the Divisional Board to notify this Department that this or that area requires clearing of noxious weeds, and to submit tenders for the cost, with the recommendation of the Board as to which should be accepted. Upon approval of the work and tender, supervision of the contract is carried out by the Board, who, upon completion of the work, certify thereto, and payment is made to the Board by this Department. With regard to reserves, those vested under trustees for certain purposes are, in connection with noxious weeds, treated in the same manner as in the case of private persons, and are cleared at their expense; and such reserves as camping, water, road metal, crossing, gravel, pasturage, quarry, and road reserves that are under the control of the

local authorities, are paid for by them, and not by this Department."

Referring to the statement above in regard to the delayed germination of the seeds of this plant, this is a fact well ascertained, and one which adds to the danger of the plant. Those who are interested in the question are invited to consult an interesting paper by Prof. J. C. Arthur, of Purdue University, United States of America, on "Delayed germination of Cockle-burr and other paired seeds." (*Proceedings 16th Annual Meeting for Society for Promotion of Agricultural Science, Springfield, August*, 1895).

The Cockle-burr in Queensland.—This weed has been established in Queensland for a number of years, and there is no doubt that it is working its way south from that Colony. In this way we obtained Paddy's Lucerne, which, year by year, moves onward into our territory. It is commonly known in South Queensland as "Noogoora-burr," covering (in 1879) no less than 500 acres on the Noogoora Estate, near Brisbane, alone. It is a well-recognised pest in the northern Colony.

Is Cockle-burr poisonous?—I have alluded to this matter in my article on the Bathurst-burr, in the *Agricultural Gazette* for July, 1896, page 445, and have expressed doubt as to its poisonous nature. Months before my article could have reached him, Professor J. C. Arthur, of Purdue University, U.S.A., wrote to me: "I am preparing an account of what we know as Cockle-burrs (*Xanthium canadense, strumarium,* and *spinosum*) for the farmers of this State. I learn that in Australia these plants, when young, are reputed to be poisonous. They do not have such a reputation in this country, and I wish to obtain all information regarding the matter I can." I sent Prof. Arthur a copy of Dr. Joseph Bancroft's paper and of my own. He replies: "I am unable to entirely account for Dr. Bancroft's results, but I am convinced that whatever may be true of decoctions of the plant, *Xanthium* is not poisonous in any form in which domestic animals will eat it in the field. I have recently been able to trace the supposed poisonous effects of *Xanthium* in one district in this State to an outbreak of anthrax."

A. Zander (*Pharm. J. Russl.*, 1881, quoted by Sohn) has examined the seeds of the Cockle-burr, and finds in them a poisonous glucoside, to which he gives the name of *Xanthostrumarin*. It is most probable that this poisonous principle is present in minute quantity, and I agree with Prof. Arthur that the form in which cattle eat the plant is innocuous. *Xanthostrumarin* develops a succinic odour on warming, and is soluble in alcohol and ether. For its behaviour with reagents, I must refer my readers to Sohn's *Dictionary of the Active Principles of Plants*.

Some Medicinal and other uses for Cockle-burr.—The plant was formerly used in medicine in Europe, and its burrs and the prickles on them are still employed in India and China; its seeds yield a lamp-oil, and are made into a flour. An extract is prepared from the roots, and in China applied to ulcers (Smith, in Balfour's *Cyclop. of India.*)

In some parts of Germany, where it is called "Spitzklette," it has a popular reputation as a remedy for ague, and in Russia it is

considered to be a prophylactic in hydrophobia. In the Punjab and Sind it is called "Gokhru kallán," or "Great Gokhru," and is given in small-pox on the doctrine of signatures (Stewart). It is described by Mahometan writers on *Materia Medica* as useful for dispelling tumors and curing ophthalmia; also in renal and urinary complaints as a diuretic, and in colic. It is said to be aphrodisiac. The Hindus consider the whole plant to be diaphoretic and sedative and very efficacious in long-standing cases of malarious fever. It is generally administered in the form of decoction. Loureiro states that the seeds are attenuant and resolvent of inflammatory swellings. Modern experiments with the drug seem to indicate that, like Jaborandi, it is sudorific, sialogogue, and slightly diuretic. The dose given has been 10 grains of dry leaves. (*Pharmacographia Indica*, vol. ii, pp. 262–263.)

How to get rid of it.—I can only say, as I have said before in respect to the Bathurst-burr, in July, 1896 (page 446), that it is too much to expect to entirely get rid of this all-prevailing pest; but, with patience, it can be largely kept in check. It should be prevented from maturing seed, and, therefore, it should be cut down with a hoe or mattock in the spring or summer; where convenient it is also desirable to burn the plants as soon as they are dry enough to admit of this being done, as large quantities of seeds are produced, the destruction of which should be ensured. Serious as has been the spread of this weed already, it is still spreading, and to permit this to go on unchecked is simply unpardonable. I am quite aware that times are hard, and that farmers and pastoralists have not, as a rule, the funds with which to employ sufficient labour for its extirpation; but, even under present conditions, much more can be done to combat this terrible pest. I would still remind those in charge of Government and municipal roads of the amount of good they can do to the country by insisting on keeping the roadsides free from the worst weeds. In this connection the roads are the arteries of the country; along them course things good and bad, and bad weeds allowed to establish themselves on the roads will as assuredly contaminate the surrounding country, as impure blood will induce disorders throughout the animal system. Let us have some enthusiasm in this matter of weed repression. I do not say establish another society, for we have enough already; but if it will stimulate zeal, let us have a society for the extermination of weeds, with vigilant branches in every township of the Colony. I would at this place again invite attention to the great length of time the seeds of the Cockle-burr maintain their vitality, thus necessitating constant vigilance.

Where found.—Southern Europe and Central Asia, whence it has spread to many sub-tropical countries.

In Queensland it is believed to have been introduced with cotton-seed imported for a plantation. Mr. T. W. Kirk, in one of the New Zealand "Leaflets for Farmers," traces its introduction into that Colony through earth ballast, deposited by a ship from Buenos Ayres.

REFERENCE TO PLATE.

A, fruit (burr); B, transverse section of fruit; C, convex and flat (furrowed) sides of a seed.

The Fodder Value of some of the Common Scrub Plants.

F. B. GUTHRIE.

THE specimens of scrub-plants, the analyses of which are tabulated in the accompanying table, were forwarded for examination by Messrs. Goldsbrough, Mort, and Co., and I am indebted to them for permission to publish these results for the benefit of readers of the *Gazette*, and also for much information of value. My thanks are also due to Mr. J. H. Maiden, Director, Botanic Gardens, who has kindly supplied me with the botanical names attached. In a few cases where, owing to the absence of flower or fruit, it was not possible to name the specimens with certainty, I have, nevertheless, retained the analysis under the common name, because, although identification in these cases may not have been possible, the plants are, nevertheless, unmistakable under the vernacular name to those living in the district whence the specimens have been obtained.

The analyses are in all cases of leaves only; though in several cases, such as belar, warriah, needle-bush, broom-bush, &c., there were no leaves proper, but only soft stalks.

These analyses are here published, more with the object of arousing interest in the matter than for any other purpose. In such evil days as those through which we have just passed, the practice of scrub-feeding has been perforce extensively resorted to. However undesirable such a practice is, it is at such times absolutely unavoidable; and if we were able to state definitely the composition and digestibility of the different scrub-plants, the ill-effects of indiscriminate scrub-cutting could be very largely reduced. The analyses here presented cannot pretend to offer final information on this point.

In the first place, the composition of these plants varies with their age as well as with the soil and climate in which they are grown. The proportion of fibre is especially variable at different stages of the plant's growth. A striking example of this will be found on comparing Nos. 8 and 15, both of belar. If we assume that No. 8, when fresh, contains the same amount of water as No. 15—that is, 19·44 per cent.—and calculate both on this basis, we shall find that No. 8 contains 42·7 per cent. fibre as against the 27·15 contained in No. 15. This is almost certainly due to the age of the plant, the young belar being more fibrous than the mature. Further, the specimens had all to come a considerable distance by rail; and though they were all packed with some care and arrived in good condition, some must undoubtedly have lost more moisture in transit than others.

The last column, giving the approximate amounts of tannin in the leaves, requires a word of explanation. This was determined in each case in the air-dried leaves. It is intended to represent the astringency

of the leaves, the estimation being in reality not strictly of the tannin, but of the total oxidisable matter in a decoction of the dry leaves. This includes, therefore, besides the tannin, all astringent substances present calculated as tannin. The amount of these astringent substances is a matter of some importance. It is reasonable to suppose that the digestibility of the plant is considerably affected by the presence of astringent matter, and this probably largely decides the harmfulness of an excessive proportion of fibre. I think it is very likely that the formation of fibre balls in the stomach, which is so frequently fatal in scrub-feeding, is especially liable to happen when the food is both dry and astringent in character, and the worst plants in the list are those which are high both in fibre and tannin. Messrs. Goldsbrough, Mort, & Co., have kindly shown me a number of letters from pastoralists, relating their experiences in scrub-feeding. From these it appears that the plants which are generally accused of forming fibre-balls are belar, kurrawong, leopard-wood, and mulga. In the case of the two latter, this is stated to occur only when the sheep eat the stems as well as the leaves, which it appears they commonly do. Now belar and kurrawong are both excessively fibrous and rich in tannin. Leopard-wood is very astringent, but the amount of fibre is comparatively low in the leaves. In the stems the objectionable combination of high fibre and tannin would be present. In the case of mulga, both the fibre and tannin are rather high, and although mulga is generally recognised as being one of the best scrubs for feeding, the complaint is also very common that stock fed on mulga eat the stalks as well, with the result of the formation of fibre-balls. Among the plants universally recognised as the best are myall, mulga, whitewood, leopard-wood, emu-bush, currajong, and wilga (the last is said to be variable). All these (with the exception of mulga) contain less than 20 per cent. fibre, and those that contain over 2 per cent. of tannin are particularly low in fibre.

It, therefore, appears that the astringency of a scrub plant is not necessarily objectionable, provided it is not fibrous; but the combination of high fibre-content with astringency is always objectionable.

With regard to the interpretation of the remainder of the analysis, and the comparison of the feeding-values, readers are referred to another article in the same number of the *Gazette*, in which this matter is treated at greater length.

It is sufficient to refer again to the list given above of the most popular scrub plants, namely, myall, mulga, whitewood, leopard-wood, emu-bush, currajong, and wilga. An examination of the analyses shows that these plants possess the following characteristics in common:—

They are among the most succulent of those tabulated, having all over 35 per cent. water; this proportion would, of course, be higher in the perfectly fresh samples. The albumenoid ratio is in all cases a very narrow one, ranging between 1 : 2 and 1 : 4—that is to say, the proportion of nitrogenous food-stuff is very high. They are low in fibre, and those containing much tannin are particularly low in fibre.

In the plants of less value as fodder, the reverse of this is the case; for instance, in warriah, belar, currant-bush, broom-bush, &c., the

percentage of water is never over 20, whilst in the eucalypts the amount of nitrogenous matter is proportionately low, the albumenoid ratio being from 1 : 5 to 1 : 11.

I think we are not justified in drawing any other conclusions than the above from the data at present at our disposal. In order to finally settle the question of the comparative value of the different scrub plants for feeding, it will be necessary to undertake a much more exhaustive and systematic series of experiments. It will be not only necessary to examine perfectly fresh plants, properly named, from different districts and in different soil, and at different stages of their growth, but it will be necessary to undertake actual feeding experiments with sheep under the most rigid conditions, and determine the digestibility of the various constituents.

This, it will be readily understood, is a bit of work involving a very considerable amount of time and labour.

Whether it is undertaken or not depends largely upon the amount of interest taken in this preliminary investigation by those interested in the subject.

The present article touches merely the fringe of the subject; but I am in hopes that the indications it affords as to the comparative values of these scrubs may not be without usefulness when the unfortunate necessity arises of resorting to this method of feeding.

ANALYSIS of the leaves of some of the common Scrub Plants.

	Water.	Ash.	Fibre.	Ether extract (oil, &c.)	Albumenoids.	Carbo-hydrates	Nutrient value.	Albumenoid ratio.	Tannin (oak-bark).
1. BOOLIGAL. (Eucalyptus largiflorens. F.v.M.)	16·07	4·13	9·05	7·24	6·75	56·76	80	1 : 11	5·6
2. APPLE TREE. (Eucalyptus Stuartiana. F.v.M.)	34·55	3·27	9·65	3·17	6·37	42·99	56½	1 : 8	6·3
3. STRINGY-BARK. (Eucalyptus macrorrhyncha. F.v.M.)	39·45	2·59	6·38	5·05	5·56	40·97	57¼	1 : 9½	2·9
4. RIVER OAK. (Casuarina Cunninghamiana. Miq.)	42·27	2·96	20·90	1·66	6·81	25·40	36	1 : 4¼	1·7
5. CATTLE-GUM. (Eucalyptus coriacea. A. Cunn.)	36·76	2·90	8·57	6·02	8·75	37·00	59	1 : 5¾	1·5
6. CURRAJONG. (Sterculia diversifolia. S. Don.)	35·61	4·99	14·54	1·70	10·35	32·81	46	1 : 3½	2·4
7. ROSEWOOD. Heterodendron oleaefolium. Desp.)	12·27	4·84	16·36	2·20	15·75	48·58	69	1 : 3½	3·7
8. BELAR. (Casuarina. Sp.)	11·70	5·66	46·86	2·80	9·06	23·92	39¼	1 : 3¼	2·5
9. DOGWOOD. (Myoporum. Sp.)	28·62	3·52	10·88	2·27	9·31	45·40	59¼	1 : 5½	1·3
10. WARRIAH.	11·32	5·14	35·92	3·81	11·93	31·88	52½	1 : 8½	1·2
11. WILGA. (Geijera parviflora. Lindl.)	47·73	5·21	7·61	2·18	14·25	23·02	42	1 : 2	2·4

ANALYSIS of the leaves, &c.—*continued.*

	Water.	Ash.	Fibre.	Ether extract (oil, &c.).	Albumenoids.	Carbo-hydrates.	Nutrient value.	Albumenoid ratio.	Tannin (oak-bark).
12. WHITEWOOD. (Atalaya hemiglauca. F.v.M.)	35·87	6·27	19·50	1·19	14·62	22·55	39¾	1 : 2	1·3
13. CURRAWONG. (Acacia. Sp.)	13·45	2·93	30·61	1·96	12·87	38·18	55½	1 : 3½	1·9
14. BUNBUTT.	23·55	7·71	16·65	4·03	13 50	34·56	56	1 : 3¼	3·0
15. BELAR. (Casuarina. Sp)	19·44	4·01	27·15	3·40	9·75	36·25	53½	1 : 4½	2·4
16. NEEDLE-BUSH. (Hakea leucoptera. R.Br.)	12·59	4·79	39·09	0·74	6·44	36·35	44½	1 : 6	1·5
17. WILGA. (Geijera parviflora. Lindl.)	50·84	5·18	8·01	2·55	12·45	20·97	39	1 : 2	2·2
18. BERRIWOOD. (Grevillea striata. R.Br.)	37·11	2·85	26·58	0·90	5·62	26·94	34½	1 : 5	1·5
19. MULGA. (Acacia aneura. F.v.M.)	39·06	3·60	29·90	2·55	9·06	15·83	30¼	1 : 2½	1·8
20. EMU-BUSH. (Eremophila longifolia. F.v.M.)	51·59	3·70	5·43	0·75	8·87	29·66	40¼	1 : 3½	2·6
21. WHITEWOOD. (Atalaya hemiglauca. F.v.M.)	37·55	6·46	22·05	1·73	11·63	20·58	36	1 : 2	1·2
22. ROSEWOOD. (Heterodendron oleaefolium. Desp.)	34·27	2·29	13·74	4·28	10·31	35·11	55	1 : 4¼	4·3
23. SUPPLE-JACK.	33·16	6.61	14·06	1·21	11·03	33·03	46¾	1 : 3¼	2·4
24. LEOPARD-WOOD. (Flindersia maculosa. F.v.M.)	41·70	3·42	11·43	3·92	9·31	30·22	48¼	1 : 4¼	2·9
25. GIDGEA. (Acacia? homolophylla. Cunn.)	41·03	8·73	22·59	2·08	7·31	18·26	20¼	1 : 3	2·0
26. SANDALWOOD. (Eremophila. Sp.)	41·84	5·62	8·82	1·73	8·62	34·37	47	1 : 4½	2·3
27. QUININE. (Alstonia constricta. F.v.M.)	51·72	3·65	9·22	1·89	9·00	24·52	37¾	1 : 3¼	1·7
28. BROOM-BUSH. Apophyllum anomalum. R.Br.)	19·70	13·22	44·76	1·57	9·94	10·72	21½	1 : 1½	1 7
29. CURRANT-BUSH. (? Leptomeria aphylla. R.Br.)	18·03	4·96	33·12	4·50	5·62	33·77	49½	1 : 7¾	1·5
30. WILD FUCHSIA. (Myoporum acuminatum. R.Br.)	33·32	3·88	5·13	1·40	9·06	47·10	59½	1 : 5½	3·0
31. COLANE. (Owenia acidula. F.v.M.)	49·01	0·86	12·47	1·12	9·19	21·35	33	1 : 2½	1·5
32. BLUE OR APPLE BUSH. (Heterodendron oleaefolium. Desp.)	24·61	4·85	19·53	1·94	12·18	26·89	43½	1 : 2½	3·3
33. MYALL. (Acacia pendula. Cunn.)	48·45	4·45	19·64	1·21	9·62	16·63	29	1 : 2	0·5
34. BRUMBLE OR WILD ORANGE. (Capparis Mitchelli. Lindl.)	28·00	8·06	18·97	1 26	13·12	30·59	46½	1 : 2½	2·3

The Interpretation of Analyses of Fodders and Feeding-Stuffs.

F. B. GUTHRIE.

IN order to be able to properly interpret analyses of fodders, a few words are necessary in explanation of the feeding of animals and the functions of the different ingredients of a fodder. Taking them in order:

Water.—The presence of water makes the food more succulent and palatable. It also renders it more easy of digestion. It takes the place of drinking water to some extent, and animals fed on watery food will require less to drink.

Ash contains the salts, such as common salt, lime compounds, phosphates, and other mineral saline substances which are essential for the food of animals. It is from this part of its food that the animal derives the material to build up its bones, which are largely composed of phosphate and carbonate of lime. All parts of the animal body contain a certain proportion of mineral ingredients and the amounts of these in the food depend upon the amount of ash. Some of the salts—like common salt—have definite physiological action, and though not properly food-stuffs, are essential to a proper digestion of food-stuffs. The amount of this ash, or saline matter, is not taken into account in estimating the feeding-value of a plant, for though small in amount it is always present in sufficient quantity to supply the requirements of the animal.

Fibre is that part of the plant which is unattacked by acids or alkalies. It is practically cellulose. It cannot be regarded as digestible, for although it disappears to some extent in the body of the animal, especially with herbivora, it is not broken down in the way that the digestible carbohydrates are attacked (see these), but is decomposed in such a way as not to produce heat, and its assimilation is probably unattended by much benefit to the animal. It has no feeding-value. Its presence is, however, essential, as it gives bulk to the food and mechanically stimulates the walls of the alimentary canal, promoting healthy digestion. Too much fibre, however, makes the food too bulky, so that the animal cannot eat sufficient of it to get the necessary amount of nourishment. It also makes the food unpalatable.

Albumenoids—Carbohydrates—Fat are the ingredients which have to be taken into account in determining the feeding-value of a plant.

Albumenoids are distinguished from the others by the fact that they are the substances which contain nitrogen. They are composed of carbon, hydrogen, oxygen, and nitrogen. The flesh and blood of

animals is composed of nitrogenous material, dry blood or meat containing about sixteen per cent. nitrogen, as do also substances like hair, wool, horns, hoofs, &c. It will thus be seen that the amount of albumenoids in the food is a point of the highest importance, since these are the only source of nitrogen available to the animal. The albumenoids are, therefore, often called "flesh formers" or "muscle formers." Their chief function is to produce the nitrogenous material of the body, and to some extent the fat, and to maintain it, replacing the daily waste of the tissues. By their combustion within the body, heat and mechanical force are also developed.

Carbohydrates is the name given to a large class of organic compounds found in plants, the principal of which are the starches and sugars. The carbohydrates are composed of carbon, hydrogen and oxygen only, without nitrogen. Their consumption, therefore, does not add to the nitrogenous substances of the body nor repair the waste. Their function is the production of heat and mechanical energy by their combustion within the body. They are often called "heat-producers," and maintain the temperature of the animal. The process of their combustion consists in combining with oxygen, and being split up into carbonic acid and water, a process identical with that of the burning of fuel. They also partially assist in the production of fat, especially when consumed in excess of immediate requirements.

Fats and Oils.—The function of these substances is much the same as that of carbohydrates. They are also composed of carbon, hydrogen and oxygen, but contain proportionately much less oxygen, and consequently much more carbon and hydrogen than the carbohydrates. They are on this account a much more concentrated form of fuel, and their combustion produces a greater amount of heat and energy than does that of starch or sugar. The following summary shows (very roughly) the functions of the different ingredients:

Ash supplies bone-material and inorganic salts.

Albumenoids supply flesh and all nitrogenous material, replace waste of tissue, supply to a lesser degree heat and energy and fat.

Soluble Carbohydrates and Fat supply heat and muscular energy; fat (when taken in excess).

The heat-producing power of fat is very much greater than that of carbohydrates, being about $2\frac{1}{4}$ times that of starch.

Cellulose even when assimilated is of little value as a heat-producer, as it is not split up into carbonic acid and water like starch, sugar, fat, &c.

Nutrient Value.—In calculating for the sake of comparison the nutrient values of different fodders, the percentages of albumenoids, soluble carbohydrates and fat are simply added together, the fat being multiplied by $2\frac{1}{4}$ to reduce it to its "starch equivalent."

Albumenoid Ratio.—This is the ratio between the albumenoid and the non-albumenoid constituents, and is obtained by adding together the percentages of carbohydrates and fat (x $2\frac{1}{4}$), and dividing the sum by

the percentage of albumenoids. This "nutrient" or "albumenoid ratio" is of considerable importance, the proper balancing of these ingredients being an important matter in feeding.

The ratio which gives the best results differs considerably with different animals, and also with the same animal at different stages of its growth and according to the purpose for which it is fed. I shall assume that the object to be aimed at is the providing a maintenance diet for sheep, in which case the amount of food required is reduced to a minimum. The attached Table gives the amounts of the different nutritive ingredients for the maintenance diet of sheep expressed in pounds per head per day for sheep of different weights :—

MAINTENANCE—DIET FOR SHEEP.

Expressed in pounds per head per day.

Weight of sheep.	Age months.	Total organic matter.	Albumenoids.	Soluble carbohydrates.	Fat.	Total nutrient matter.	Albumenoid ratio.
56 lbs.	5 to 6	1·6	0·18	0·87	0·045	1·095	1 : 5½
67 lbs.	6 to 8	1·7	0·17	0·85	0·040	1·060	1 : 5½
75 lbs.	8 to 11	1·7	0·16	0·85	0·037	1·047	1 : 6
82 lbs.	11 to 15	1·8	0·14	0·89	0·032	1·062	1 : 7
85 lbs.	15 to 20	1·9	0·12	0·88	0·025	1·047	1 : 8

This table is taken from Johnson's text-book, and refers to English conditions, and I am not sure whether the weights of the animals at different ages, or the quantity of food required, are the same as with us. The difference between the total nutritive matter and the total organic matter consumed is undigested material, such as fibre, &c.

From this it will be seen that the older sheep require a larger amount of actual food than the young, but that this excess consists chiefly of undigested matter, and that the old sheep require a smaller quantity of nutritive material than the young—little more than enough to replace the waste of tissues and to maintain the body temperature. The young sheep, in addition to requiring a larger amount of nutritive matter than the old, require a larger proportionate amount of nitrogen in their food in order to supply material for their growth. The proper nutrient ratio for a lamb is, therefore, much narrower—more nitrogenous—than for a full-grown sheep. We are now in a position to make use of the table which follows, giving the composition of some fodders. It must, however, be remembered that one very important point has been omitted, namely, the digestibility of the different constituents. For example, the proportion of any ingredient which is digested varies in different foods and in different animals, and also in the same animal, under different conditions, such as age, &c.

TABLE showing composition of certain Fodders.

	Water.	Ash.	Fibre.	Albumenoids.	Carbohydrates.	Fat.	Nutrient value.	Nutrient ratio.
Wheat (grain)	10 5	1·8	1·8	11·9	71·9	2·1	88·5	1 : 6½
Oats (grain)	11·0	3·0	9·5	11·8	59·7	5·0	82·8	1 : 6
Barley (grain)	10·9	2·4	2·7	12·4	69·8	1·8	86·2	1 : 6
Maize (grain)	10·9	1·5	2·1	10·5	69·6	5·4	92·2	1 : 7¾
Bran	11·9	5·8	9·0	15·4	53·9	4·0	78·3	1 : 4
Oaten straw	9·2	5·1	37·0	4·0	42·4	2·3	51·5	1 : 12
Wheaten straw	9·6	4·2	38·1	3·4	43·4	1·3	49·7	1 : 13½
Lucerne hay	8·4	7·4	25·0	14·3	42·7	2·2	61·9	1 : 3⅓
Turnips	90·5	0·8	1·2	1·1	6·2	0·2	7·7	1 : 6
Cocoanut cake	7·3	5·4	9·7	17·2	41·3	19·1	101·4	1 : 5
Pumpkins.—Average of whole fruit including rind and seeds.	85·5	1·2	2·8	3·2	4·8	2·5	13·6	1 : 3¼
Molasses	25·0	5·0	—	—	70	—	70	—
Bran (½) and molasses (½)	18·0	5·4	4·5	7·7	62·0	2·0	74·2	1 : 8½
Pasture grass	80·0	2·0	4·0	2·6	9·7	0·8	14·1	1 : 4½

Taking pasture grass as typical, and neglecting the question of the digestibility of the ingredients—assuming, in short, that the nutritious matter is completely digested—an animal consuming 8½ lb. per diem of grass of this composition would get the following amounts:—

Total Organic Matter.	Albumenoids.	Carbohydrates.	Fat.	Total Nutritive Matter.	Albumenoid Ratio.
1·45	·22	·82	·068	1·108	1 : 4½

An amount that is very near to that required by a young sheep of 56 lb. weight.

Supposing we wish to feed with oil cake, we find, in the first place, that the albumenoid ratio is nearly the same as that required in the food suitable for our sheep, and that it is about seven times as concentrated—

that is to say, the sheep will get as much nutritive matter, and in the correct proportion, from 1 lb. 3½ oz. of oil cake as from the 8½ lb. meadow-grass. But the question of bulk comes in; the food is too concentrated and too dry, and requires to be mixed with something that will give bulk and water, to render it palatable or digestible.

Suppose we have to feed with lucerne hay, we can calculate that the requisite amount of nutritive material for the day's consumption is contained in 2 lb. of lucerne hay. This will give us about the right amounts of carbohydrates and fat—·85 lb. and ·044 lb. respectively—but a large excess of albumenoids—·28 lb. instead of ·18. That is to say, the albumenoid ratio is too narrow, and it will be necessary to mix it with less nitrogenous food, such as straw, chaff, &c. An example of such admixture and the effect on the albumenoid ratio is the mixture of bran and molasses (*see* Table). These examples are merely intended to show the general principles on which fodder-values are based. The figures given are not correct, as the amounts of the different ingredients actually digested are not taken into account, and these vary with different foods.

These notes are necessarily very incomplete, and are only intended to afford a rough guide to the proper interpretation of fodder analyses and the general principles that underlie scientific feeding. The question of the digestibility of the different fodders for different animals has not been satisfactorily worked out on account of the immense difficulties attending the investigations. Also, the palatability of different foods is an important factor in their value, as are the beneficial effects of a variety of diet.

Scarifying Maize Crops.

Mr. W. Dowling, junr., of Lochiel, Pambula, writes:—"I have taken *Gazette's* advice about well scarifying maize crops, and consider it pays me double."

To show the great value of cultivation in connection with the growth of maize on the College farm, the following details might be repeated here:—

That uncultivated only gave	... ...	35·22
Cultivated, once	... ...	38·50
,, twice	... ...	41·37
,, thrice	... ...	61·42
,, four times	... ...	61·42

A further experiment was carried out during the drought. The plots of maize actually disappeared entirely when not cultivated, while those cultivated produced about 15 tons of fine succulent fodder.

Western Grazing Problems.

Conservation of Fodders for Droughty Periods.

By R. W. PEACOCK.

In the vast area of western New South Wales, which is subject to ever-recurring droughts, and pasturing its millions of sheep, a system of conservation of fodders is urgently needed to minimise the heavy losses which from time to time are experienced by the grazier. The question is rather a vexed one, and very little has been done in the past in placing upon record practicable methods whereby the desired object could be attained. The lack of authentic information has militated very materially against any universal attempts to conserve even the natural herbs and grasses, which in certain seasons grow in such profusion as to make the conservation of them profitable and practicable. In comparatively few instances do we find any provision whatever made to ward off the disastrous results of the droughts which have left their millions bleaching on the western plains.

The droughts of the future must be even more disastrous than those of the past, owing to the eating out of many of the natural grasses, herbs, salt-bushes, and edible trees.

The time is now opportune to inquire into the most practicable methods for ameliorating the severe conditions which must undoubtedly occur in the future.

Amongst the natural forage plants worthy of more attention for conservation purposes, are the many grasses, such as Mitchell, blue grasses, panicums, wild sorghums, and probably some of the kangaroo grasses. Some herbs, such as crowsfoot and trefoil also, could be utilised to advantage together with the many salsolaceous plants which are so admirably adapted to many of the western soils. The introduction of fresh forage plants and the cultivation of cereals, millets, and sorghums should play no unimportant part in this work. The diversity of opinion respecting the feeding values of many of the native grasses is no doubt partially attributable to the differences in the soil upon which they are grown. Authentic information is much needed upon this question, as it would prove a valuable basis upon which to work. At present there are many conflicting opinions by men of wide and varied experience. Also there are various opinions held respecting the practicability of conserving the natural forage plants, many experienced men contending that the seasons which would permit of any such thing are few and far between. Under the conditions which obtain upon most pastoral holdings the adoption of some method of conservation would be attended by many drawbacks,

and upon a great number it would be impracticable. But there is no reason why something should not be done upon many holdings which are better adapted to the economical storing of the native fodders.

Bush Hay.

In seasons following upon prolonged droughts, which have caused the death of millions of stock, the country is necessarily lightly stocked, and the plains are seen waving with the natural grasses several feet in height; chief among them being the Mitchell grasses, blue grasses (*Andropogon*); Australian millet (*Panicum decompositum*); tall oat grass (*Anthisteria avenacea*), as also various panick and kangaroo grasses. Many of these would well repay the trouble of conserving upon land fitted for the use of the necessary machinery. Any method which will not allow of the use of labour-saving machinery could not be considered practicable, and would not be entertained by practical men. If grasses are to be conserved, it must not be at too great expense; and this aspect of the question works more than any other against a universal practice of bush haymaking. In too many instances where the best grasses grow the cost of preparing the land for the use of machinery would be altogether too high, as the many crab-holes, gilgais, tussocks, trees, etc., would seriously interfere with the various operations. But such obstacles are not present in all cases, and the cost of clearing a few hundred acres in many instances would be but trifling.

To carry such a work out satisfactorily, reserves of suitable country should be set aside and fenced, cleared of all impediments, and kept free from stock. Such a system would result, in many seasons, in providing suitable pastures for conserving by haymaking or silage.

On many holdings many hundreds of tons could be conserved at a minimum cost; upon others, the advantages derived would not compensate for the outlay; and I am of the opinion that the latter holds upon the majority of places. It must not be forgotten that a magnificent crop of grass could be rendered almost valueless by allowing it to stand too long before cutting, as the majority of our grasses seriously deteriorate after passing from the green state. Amongst those which retain their valuable edible qualities are the Mitchell and blue grasses, these making splendid hay upon their own root stocks, and stock will do well upon them whilst any vestige remains. But with too many others the reverse obtains, as with the kangaroo grasses, many of which are completely useless when allowed to mature. A great amount of prejudice against some of these grasses is due to the practice of allowing them to ripen before making them into hay, and also by faulty curing. In many instances wheat or oats would be rejected by stock, if subjected to the treatment accorded some of the bush hay, and are likely to be wasted unless chaffed, a system which could be followed to advantage with bush hay, especially if comprised of many varieties. The question of proper curing is a vital one, the retention of the nutritive properties being the great consideration. This can be done by a proper system of hay-making, but would require no small amount of experience and attention.

Ensilage.

In many instances it would be more profitable to convert the grasses into silage, by which means numbers of varieties could be utilised which would otherwise be worthless. By this method a greater diversity of forage plants could be used, and in many instances grasses could be profitably mixed with the herbs and saltbushes in the silo, thus producing a fodder similar to that accessible to the stock in the ordinary pastures. Stock would relish such a mixture and thrive upon it. Properly made, silage would be cheaper and more nutritious than hay made from the same material, and would not require the amount of attention necessary to the proper treatment of hay. Making the silage in stacks is the cheapest method, but requires a large bulk of stuff for treatment, for if the stack is too small the loss is too great, and the larger the stack, within reason, the more valuable the silage. Some method must be devised to keep the stack perpendicular until it has settled, or otherwise the unequal drying on either side will cause it to tilt and prove very troublesome. The outside wants trimming well with a hay knife to minimise the waste, and the stack should be carried sufficiently high to create a good pressure, and when finished should be weighted with stones, bags of sand, or other heavy material, or otherwise a large quantity at the top will be mouldy and useless. It should then be covered to prevent ingress of rain. This is a system of making silage both cheap and effective and one which could be undertaken upon almost any holding where sufficient material was available. There are many other devices for applying pressure to stacks but owing to the cost are not available to the majority of holders.

The underground silo is giving place to the aboveground circular wooden cylinder silo, which can be erected at a very small cost, and is most effective, especially when used for chopped sorghums, corn, etc. (see *Agricultural Gazette*, p. 1195, October, 1898).

Cultivated Crops.

Although there are many excellent grasses which could be profitably conserved, as also herbs, such as trefoil and crowsfoot, which grow in such profusion in certain seasons, the number of seasons upon which these can be relied are perhaps too few for the making of extensive preparations for their conservation. There are not wanting instances where large quantities of bush hay have been conserved, and have proved of great value to the provident flockmaster in seasons of dearth. And in too many cases, where similar provision could be economically made upon country not possessing the disadvantages above enumerated, the conservation of the natural forage plants has not been given the attention which it deserves. Unfortunately the application of such measures can never become general, and the majority of pastoralists must fall back upon the cultivation of crops which can be relied upon with greater certainty. The cultivation of cereals for hay has been successfully adopted in many places which a short time ago were deemed unsuitable through climatic disadvantages. And upon those holdings where the practice of growing crops has been

followed very encouraging accounts are given, and although they are subject to a few failures the successes more than compensate for the expenditure. It is realised by many undertaking this work that they would be more successful if they had a better knowledge of agriculture, and losses are often due to the lack of practical knowledge necessary for profitable farming. Besides the cereals there are many other profitable crops which could be grown to advantage in favourable seasons, amongst them being the sorghums and millets; these are heavy yielders and would produce many tons which could be conserved as ensilage. The experiences of past seasons teach that such could be profitably attempted, and although requiring a considerable amount of capital to carry to a successful issue, the warding off of such disasters as are periodically sustained would warrant the outlay, which could be minimised by the co-operation of the landholders.

The conservation of fodders must play an important part in the raising of wool and live stock, the best modes of conservation and the varieties of forage plants to cultivate requiring a lot of attention by all concerned. The Agricultural Department is endeavouring to demonstrate the best varieties of crops to grow and the best methods of conserving them in order that landholders may be saved the necessity of carrying out expensive experiments, which too often end in failure from lack of sufficient knowledge of detail in the treatment of the various forage plants. On many stations good work in this direction has already been done, and it will be a very pleasant task to reproduce in the *Agricultural Gazette,* for the guidance and encouragement of those who have been less fortunate, any information that the pioneers in this great undertaking care to furnish as to the systems under which their success has been achieved.

Storing Chokos.

Mr. C. D. Paterson, of Summer Hill, writes:—"It will be remembered that in May last I asked for information in regard to the preservation of chokos, when Mr. Valder, of Hawkesbury College, advised me to try dry sand. I have done so, and for the information of all interested give the results of my trial. I placed the chokos in layers in a box in perfectly dry sand, covering each one completely, and not allowing them to touch at all. In about a month one or two shoots appeared. I did not disturb these, but at the end of another month there were still more. I left the whole of the chokos in for a month longer, and overhauled the vegetables. I found that fully 60 per cent. had made shoots, and the remainder were practically unfit for eating, being rather waxy in flavour and altogether far from agreeable, and were very little drier than when eaten fresh off the vine. I also allowed a number to stop on the vine when it died down, but these were very unsatisfactory also; they became yellow and had the same disagreeable taste. From this it will be seen that unless a better way can be found for preserving them it will be necessary to eat up the chokos as they mature. I am of opinion also that pitting would be still less successful and would be more likely to cause them to shoot."

Formulæ for Preparing Fertilisers.

F. B. GUTHRIE.

No. 12.

For Pasture-grass.

	Quantity per half-ton.	Cost. £	s.	d.
Sulphate of ammonia	420 lb.	1	18	0
Superphosphate	500 lb.	1	1	3
Sulphate of potash	200 lb.	1	7	0
	10 cwt.	£4	6	3

Mixture contains—

Nitrogen ... = $7\frac{1}{2}$ per cent.
Phosphoric acid = $7\frac{1}{2}$ per cent.
Potash ... ... = 9 per cent.

Apply at rate of 3 cwt. per acre.

This will give per acre—

$22\frac{1}{2}$ lb. nitrogen ...
$22\frac{1}{2}$ lb. phosphoric acid } per acre.
27 lb. potash ... ...

at a cost of £1 5s. 6d. per acre.

No. 13.

For Tomatoes.

	Quantity per half-ton.	Cost. £	s.	d.
Sulphate of ammonia...	320 lb.	1	7	0
Superphosphate	500 lb.	1	1	0
Sulphate of potash	300 lb.	2	0	6
	10 cwt.	£4	8	6

This mixture contains—

Nitrogen ... = 6 per cent.
Phosphoric acid = $7\frac{1}{2}$ per cent.
Potash ... ... = $13\frac{1}{2}$ per cent.

Apply at the rate of 5 cwt. per acre.

This will give—

30 lb. nitrogen ...
$36\frac{1}{2}$ lb. phosphoric acid } per acre.
$96\frac{1}{2}$ lb. potash ... ...

at a cost of £2 4s. 3d. per acre.

No. 14.

For Pumpkins, Melons, &c.

	Quantity per half-ton.	Cost. £	s.	d.
Dried blood	500 lb.	1	5	0
Super.	470 lb.	1	0	0
K_2SO_4	150 lb.	1	0	0
	10 cwt.	£3	5	0

Contains—

$N = 5\frac{1}{4}$ per cent.
$P_2O_{31} = 7$ per cent.
$K_2O = 7$ per cent.

at rate of $4\frac{1}{2}$ cwt. per acre.

$23\frac{1}{2}$ lb. nitrogen.
$31\frac{1}{2}$ lb. phosphoric acid.
$31\frac{1}{2}$ lb. potash.

at a cost of 30s. per acre.

No. 15.

For Potatoes.

	Quantity per half-ton.	Cost. £	s.	d.
Dried blood	400 lb.	1	0	0
Superphosphate	500 lb.	1	1	3
Sulphate of potash	220 lb.	1	8	0
	10 cwt.	£3	9	3

Contains—

Nitrogen .. = $4\frac{1}{4}$ per cent.
Phosphoric acid = $7\frac{1}{2}$ per cent.
Potash... ... = 10 per cent.

Applied at the rate of 6 cwt. per acre.

$25\frac{1}{2}$ lb. nitrogen,
45 lb. phosphoric acid
60 lb. potash,

and will cost about £2 per acre.

Catch Crops.

J. L. THOMPSON,
Government Agricultural Instructor.

THE large number of inquiries from all sides concerning the culture and uses of what are commonly called catch crops afford very gratifying evidence of a desire on the part of agriculturists to devote more attention to the all-important question of rotation of crops, and the adoption of systems under which every inch of the farm is producing something all the year round.

I find wherever I go that there are farmers who have not yet availed of the opportunities in the shape of literature on these subjects the Department places in their way for instruction, and therefore I find it incumbent upon me to go over to some extent the same ground I have previously traversed in the treatment of the matter.

The following brief paragraph, under the above heading, appeared in the *Adelaide Observer*, under date 5th September, 1885 :—"We have inspected a splendid crop of wheat on the Beefacres Estate, . . . in respect to which the farming community in South Australia ought to be especially interested. Two years ago the field of 150 acres was sown for wheat, but the yield was so poor that the crop was not worth reaping, this result being attributed to long cropping with cereals, which had made the land wheat-sick. Mr. J. L. Thompson, the new manager, then determined to try the effect of a rape or colza crop, and this was sown at the rate of 6 lb. of seed to the acre, without manuring. The rape turned out well, and travellers by coach on the Ti-Tree Gully Road used to talk about the splendid crop that was to be seen on that journey. The rape served to feed many hundreds of sheep for some months,* and then the land was deeply ploughed up and thoroughly pulverised, and, in due season, again sown with purple straw wheat at the rate of 45 lb. an acre, without any manure whatever. The crop was reaped with three 'Hornsby's' and one 'Walter Wood's' string binders, it stood closely at about 5 feet high, and gave 2 tons of straw and 30 bushels of wheat per acre. This extraordinary result of rotation of crops without manure and with no extra cultivation except ploughing a little deeper than usual, and especially considering

* It may be stated that the sheep here mentioned comprised 2,000 full-mouthed merino ewes purchased at 5s. each, four months' credit. They were put to Southdown rams, and produced 96 per cent. of fine lambs. The lambs were sold at an average of 8s. 6d. to the butchers. The old ewes were kept on the rape, when they rapidly became fat, and were sold to the butcher at an average of 7s. 3d., the whole transaction being completed within a limit of ten months. Mr. W. W. Hood, of Burenda, who owns a farm near Toowoomba, Queensland, fattened 1,800 sheep in relays of 600 at a time during one season from 45 acres of rape. Catch cropping of this kind is now the Australian stockowners' trump card.

the dry season experienced at Beefacres, only 12 inches of rain having fallen during the growing season, ought to be instructive to all farmers in Australia."

The Growth and Uses of Rape.

The growth and uses of rape are not known or appreciated by the average farmer in these colonies, but a few in South Australia, Victoria, and New South Wales have grown it for many years with great success.

I saw in a Victorian paper not long ago, the editor of which has some pretentions to agricultural knowledge, this plant described as a new kind of grass, and as very valuable for feeding sheep, &c. Rape has no affinity to the grass family (Graminaceæ); it belongs to the Crucifers. Rape (*Brassica campestris*) is extensively grown in some parts of Europe for the oil expressed from its seeds, and to provide pasture that will fatten sheep readily. The rape plant is a native of Europe, perhaps of England, but it is hard to say where it is actually indigenous and where naturalised. It bears a close resemblance to Swede turnip in the early stages of its growth, but usually attains a greater height than the turnip, and produces more of stem and leaves. It has a fusiform and stringy root, while that of the turnip is bulbous. On average soils, when grown in drills, it usually reaches a height of from 18 to 20 inches, but on soils very rich in vegetable matter it sometimes attains a height of between 2 and 3 feet.

There are several varieties of rape, but the only kind I have had any experience with as a pasture is known as the Dwarf Essex.

Like the turnip, rape is adapted to temperate climates. It will be found to grow in temperatures that are cool rather than warm. In New England and other cool regions of this Colony it will grow best during the summer months, but on the Hawkesbury, and in all warm regions it will grow best during the winter months. The most suitable soils for growing rape are fairly moist free-working loams, rich in organic matter. Black loams are also suitable, containing, as they generally do, a large amount of humus. Good maize, potato, or turnip land will grow rape. It will also grow on clay soils after the plants get a start, but not so luxuriantly as on the other soils I have mentioned. Rape as a rotation crop cannot, in my opinion, be excelled. As the extract at the commencement of this article shows, I had wonderful results with the plant in recuperating old worn-out wheat land in South Australia. At Dookie I had a similar experience. There, a paddock of 40 acres which in 1886 had been sown with wheat, was not worth cutting, so poor had the returns been reduced from continued cereal growing. In January of the year following I ploughed the land deeply, and exposed the soil to the ameliorating influence of the hot summer sun. Towards the end of March I had it thoroughly cultivated fully 6 inches deep with scarifier, disc harrow, ordinary harrows and roller, until it was brought to a tilth equal to the proverbial "onion bed." Early in April, and just after the first autumn rains, with sufficient moisture to ensure the rapid germination of the seed, I sowed the rape broadcast, at the rate of 6 lb. to the acre on the finely-harrowed surface. To cover the seed, I simply

passed the roller over it. This, I may say, is sufficient covering, the smaller seeds if buried too deeply do not germinate, and the seedsman is blamed unjustly. Nature sows her seeds very shallow, and they germinate and grow well, especially if they are not wanted to.

The plants appeared in less than a week, and the rough leaf in a fortnight. Owing to the moisture and warmth at that season of the year, it grew like magic, and by the end of May was fit for the ewes and lambs. Over twelve head per acre were pastured on this rape, besides numerous milch cows and other cattle, until January, 1888, when the residue, with all the sheep droppings, was ploughed under, but not too deeply. The land was allowed again to sweeten for a few months, and the vegetable matter to decompose. It was next sown with "Chevalier" barley, in the proportion of 1 bushel to the acre—this was towards the end of April. The yield was 25 bushels to the acre of a magnificent sample of malting barley, which was sold for seed at 6s. 6d. per bushel. This prosperous result was gained in a season when the rainfall for the whole year was only 14·51 inches.

In the following year this land was again sown with "Chevalier" barley, and produced a prime sample, which yielded 20 bushels to the acre. In 1890 I sowed this land with Cape barley, oats, a little rape, vetches, peas, and beans for an ensilage crop, and secured a yield of fully 10 tons to the acre of prime succulent herbage. This was cut in November, the land was manured with farm-yard compost, and immediately sown with sorghum, which yielded in the following February 15 tons, being 25 tons per acre of cow feed in a dry district.

But to return to rape. I have secured better results by sowing it in drills, and, when the ground requires cleaning, this is the best method of cultivation. When drilled in from 1½ lb. to 2 lb. of seed to the acre will be sufficient; but when broad-casted, 5 lb. to 6 lb. will be necessary. The seed can usually be purchased at 3d. per lb., so that the cost of the seed is very small.

When sown in drills, as the rough leaf appears on the plant, the horse-hoe should be freely used between the rows to keep down the weeds, and to keep the soil open and loose, fracturing the capilliary tubes which bring the moisture from the lower strata, and is dissipated into vapours in the air. No attention need be given to the thinning of rape. Rape being an excellent cleansing crop when grown in drills and cultivated, it may, with advantage, be grown between two crops of grain.

Rape can also be grown as a catch crop, *i.e.*, as soon as a cereal crop is removed, if the land is not too stiff, the stubble land may be simply scarified, harrowed, and brought to a fine tilth, and the seed sown. The crop may be either pastured or ploughed in as green manure.

Rape makes a capital soiling crop. The crop can be cut down and fed to cows or other animals in a shed, or scattered over a small paddock or yard. But it is as a farm manure that rape is of so much value to the Australian farmer in recuperating his worn-out wheat-sick soil. The question may fairly be asked, how can the growing of rape without manure, and ploughing it in, improve the fertility of the land, seeing that nothing is added to it, but that is only restored to it which

was taken out by the crop? To this inquiry I reply, the benefits of a rape crop, so far as I can judge, are as follows:—Science teaches us that a large proportion of the leaves and stalks of succulent herbage is composed of substances taken from the atmosphere, such as moisture, carbon, nitrogen, oxygen, &c. The roots of the rape plant permeate the soil, and draw to the surface from the subsoil valuable plant-food. The rootlets improve the mechanical texture of the soil, and enrich it in their decay, and the whole plant when ploughed in decomposes, thus contributing considerably to the fertility.

Rape contains about 8 per cent. of carbo-hydrates, 2 per cent. of albumen, and a little fat. It cannot be excelled for fattening old ewes, or producing fat lambs for the market. When very young and succulent rape is liable to scour sheep; to prevent this, a little hay or straw chaff should be within reach of the animals to counteract this tendency.

In New Zealand and Canada half a pint of oats per sheep is allowed, with very payable results. Rock salt, in all cases, should be within reach of the sheep.

Rape is not suitable as a food on which to feed milch cows exclusively, as it taints the milk. It is, however, capital food for pigs, and they are very fond of it.

Fertiliser for Rape.—Although rape will give a profitable return during an average season on fair land, thoroughly cultivated, without manure, it is responsive to an application of farm-yard manure. It is probable that the application of a complete fertiliser will give satisfactory results.

From experiments carried out with fertilisers applied to this plant at the Ontario Agricultural College Experiment Station, Canada, the best results were obtained from the application of nitrate of soda, and the next from the application of salt.

Precautions to be Observed in Feeding with Rape.—Stock should never be turned into rape when hungry—otherwise they will eat too much of it and become blown, and probably a large percentage may die. When the man in charge of the sheep at "Beefacres" put 2,000 ewes into 150 acres of rape for the first time, he lost eleven head within two hours. He then took them out, and put them into a bare paddock; the sheep all lay down at the gate, wanting to get in again to the rape. When the gate was opened they required no dog to drive them back to the rape; they rushed in at full force, and being empty with their long fast, commenced eating most ravenously, with the result that twenty-two died within an hour. The shepherd, terrified, took them all out, and came to me to report progress. I instructed him to then put the sheep in with a full stomach, and leave them there. He replied to the effect that if he did this I should lose the half of them. I assured him I would take all responsibility. We had, at the time, a field of winter-proud wheat, and next morning I went up and gave instructions to let the sheep into the wheat-field, where they filled themselves thoroughly.

The rape paddock adjoined the wheat one, and the gate was opened, so they quietly passed from the wheat into the rape. Being so full of

wheat, which, by the way, does not blow them like rape, they could not eat the rape so greedily, and, consequently, did not fill their stomachs with gases. We did not move them again for two months, but they had the run of a dry grass paddock, nor did we lose another sheep. It is the worst possible plan to put stock into succulent herbage, such as lucerne, rape, clover, &c., for a brief period, and then remove them to a bare paddock. The sheep, which has less brain for its size than the rest of our domestic animals, has, I incline to believe, some reasoning power, and no doubt reasons somewhat thusly:—"If I am allowed to remain only half an hour in this fine rape, I must make the most of my time," and the consequence is rapid feeding, which speedily distends the rumen or paunch with gas, and if relief is not soon obtained, death ensues.

I have been very successful with cattle and sheep, when first put on to succulent herbage, by simply putting them on with full stomachs, and then leaving them there. Owners of pure bred pedigree stock should use great care when pasturing valuable animals on rape.

In my opinion there is great room for the extension of the rape industry in Australia. One acre will fatten ten lambs. I know of no other plant of the same importance so likely to assist to develop and fatten a cross-bred or long-woolled sheep suitable for the English market. In this respect rape is much superior to turnips, inasmuch as it will grow in many parts of New South Wales where turnips would fail.

Since the above was penned many farmers in this Colony have grown rape with great success. Mr. John Fagin, Sunny Ridge, Mandurama, on my advice, sowed a large area last year, and notwithstanding the dryness of the season, reports that it was the means of saving thousands of his sheep, and actually fattened them at a time when there was practically no other food. The growing of rape for recuperative purposes is of far more value than bare fallow. Dwarf Essex, or Broad-leaved Dutch gives the best results.

A short time ago the Central Agricultural Bureau of South Australia received the following communication from a gentleman who had gone in for rape growing. He said:—"I sowed 42 acres of rape on the 21st of September, 1892, simply ploughing the ground and harrowing once, in peat soil. I sowed 3 lb. of seed to the acre, and on the 23rd of December I put 1,400 sheep on to fatten. About 3,000 got in accidentally, but as there was an abundance of food I left them all in for a fortnight. On the 2nd instant I sent 1,022 fat sheep to the Adelaide market, and have at the present time 500 on the same crop fattening. These sheep have all through had the run of about 200 acres of grass, but had they not had the rape sown they would not have fattened. Neither rape, mangels, nor kale will fatten sheep, however, without some dry grass to graze on also. I find that rape will not grow well in the winter, but I consider it a wonderful fattening herb, as the above results will show, and the stem when eaten will again sprout, giving more feed." A New Zealand grower, in the Riverside district, gives an equally wonderful account of the fattening properties of rape. He sowed 86 acres with this crop, and

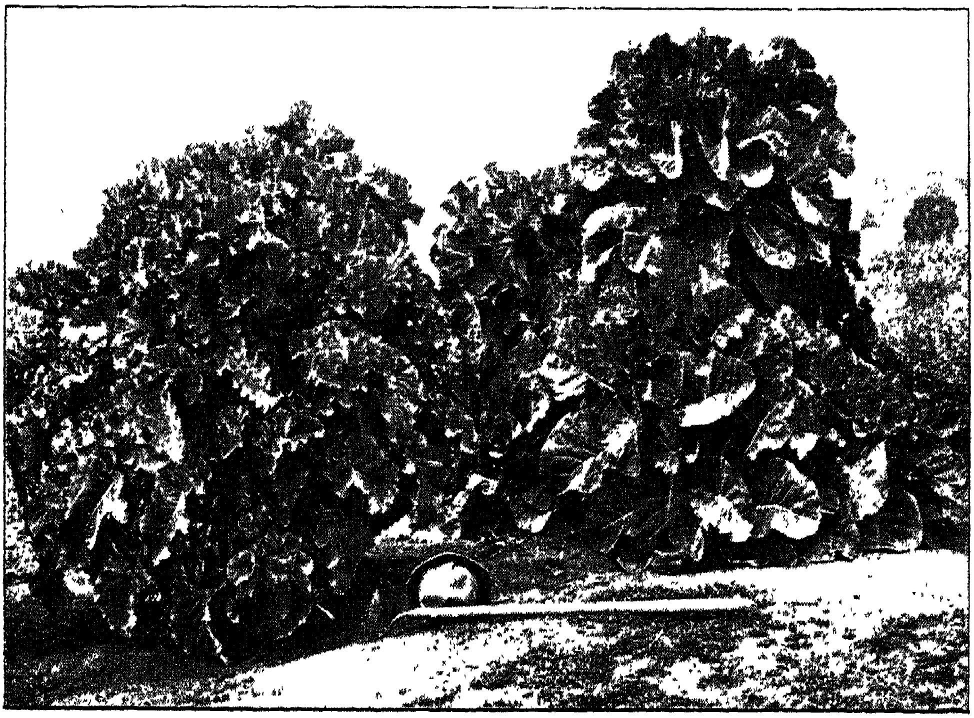
started feeding off about the middle of January. According to the latest account received he has so far fattened over 2,000 sheep on it, and a few weeks ago sold 1,800 in one line at a big figure, every sheep being in prime condition. The account we have read states that there are now 700 sheep feeding on the rape, and of these 400 will be fit for the freezing chamber before the end of the month, while the balance will be in good forward condition. Doubtless many farmers will be disposed to question the accuracy of these statements, but as we have known fourteen sheep per acre to be fattened in a rape field, we are inclined to accept the reports as being quite true. Rape should be more extensively cultivated in this Colony, and it would pay all farmers having suitable land to give it a trial.

Thousand-headed Kale.

Judging from the number of letters which this Department is constantly receiving from all parts of the Colony, asking for information about different forage plants and grasses, it is quite evident that at no previous time in the history of the Colony has this subject occupied so much of the attention of both pastoralists and farmers, more especially dairy farmers. The establishment of butter factories in different parts of the Colony has undoubtedly convinced dairymen of the fact that unless milch cows are regularly supplied with good herbage, they will not yield a great quantity of milk. It therefore becomes necessary, if the industry is to be kept going for many consecutive years, and is to be carried out on successful commercial lines, to pay more attention, not only to pastures and pasture plants, but to auxiliary forage crops also; the latter to be either cut and used in a green state, or turned into ensilage, to supply rich succulent feed during times when other herbage is scarce.

Amongst some of the best auxiliary crops for winter use in the colder parts of the Colony would be the cattle cabbages and kales. These crops are largely cultivated in Europe, and are highly spoken of, after many years of experience, as affording a great amount of nutritious fodder, which does not disagree with any kind of stock. To encourage the cultivation of some of the most suitable of these crops for this climate, the Department, two years ago, distributed a few small packets of Jersey tree kale seeds to some farmers, and where the instructions, issued with the seed, were carried out, the result has been highly satisfactory. Although this crop has only been grown in an experimental way, still the good results obtained will no doubt lead to its being grown on a more extensive scale in the near future in those districts which have been found to be the most suitable for its development.

The Thousand-headed Kale which is figured in this issue, differs from the Jersey tree Kale in its more dwarfed habit of growth, its stems being divided into a number of leafy branches, and in its leaves not being quite so large. It is, however, considered to be more productive to a given area. The Thousand-headed Kale can be recommended, as an auxiliary crop, to dairy-farmers, living in what may be aptly termed the English climate parts of New South Wales.



THOUSAND-HEADED KALE AND JERSEY TREE KALE.

It is of no use attempting the cultivation of this crop in the drier or hotter parts of the Colony, as it would only lead to disappointment, except, perhaps, under irrigation, but even then, during the summer months, aphides and other pests are often so very troublesome that they would not only be likely to retard the growth of the plants, but also render them unhealthy. As this crop would only be likely to be of the greatest value to the dairymen during the winter months when other herbage is not so plentiful, the seed should be sown in August or September, according to the state of the weather. In a favourable season, however, if it was desired, an almost continuous supply could be obtained by sowing the seed in spring and autumn. The Thousand-headed Kale has been grown with great success in Victoria, and seeds are now obtainable at the principal seed warehouses in the Colony.

The following extracts on the cultivation and uses of the Thousand-headed Kale are from Sutton's *Farmer's Year Book*:—

Manures required.—The lesson to the cultivator is, that in preparing for a kale crop it is necessary to choose a soil containing sulphates, phosphates, soda, and potash salts in considerable quantity; or, if the soil is deficient in these materials, they must be added in suitable proportions. The lime may be applied separately, should the soil not contain sufficient, but the plant must have it. A deep well-tilled loam will suit this plant admirably, and if the land is adhesive, even inclining to clay, so long as it works freely, there are the conditions for a grand paying crop to start with. Speaking generally it may be said that the lighter the soil, the greater need for abundant manuring, and the stiffer the land, the more the necessity for deep tillage and thorough cultivation, to give the roots ample opportunity of ramifying freely. From twenty to thirty loads per acre of good farm-yard manure will not be too much for this crop. Where farm-yard manure is not available, the following proportions of artificials can be recommended per acre: sulphate of ammonia, 1 cwt.; kainit, 3 cwt.; superphosphate of lime, 3 cwt. The kainit and superphosphate of lime are best applied mixed at the time of sowing, but the sulphate of ammonia must not be combined with the other manures. The last named article should be got in separately before drilling in seed or transplanting, and, if possible, just prior to a fall of rain.

Culture.—There are two modes of cultivating kale—(1), by drilling in the seed where the crop is to grow, and (2), by raising plants in a seed-bed, and transplanting. The former practice requires from 4 to 6 lb. of seed per acre; for the latter purpose, 1 lb. is sufficient. A smaller quantity would answer for drilling, if every seed were certain to be in the right place, and the young plants had no enemies. The cost of seed is greater for the drill than for the seed-bed, but this difference is more than neutralised by the additional expenses which the transplanting system entails, to say nothing of the loss which is involved in seriously checking the growth of the plant. The saving of labour effected by the drill is alone a very considerable item; therefore, we unhesitatingly advise the practice of drilling. The seed should be drilled in rows 30 inches apart, and when the seedlings are well above ground, they should be thinned out to 30 inches apart in the rows.

Seed-bed.—Should the seed-bed be decided on, make the soil thoroughly rich and friable, so that when the young plants are drawn from it, the fibrous roots may be as little injured as possible. Sowing in rows is desirable, for the crop can then be kept clean, and is altogether more manageable than when the seed is sown broadcast. From the outset every plant must have space enough to make a stocky growth, or the seedlings will be leggy, and never afterwards develop into the splendid proportions attained by plants that have been short and stout from the commencement.

Transplanting.—A dull or showery day should be selected for transplanting. Allowing 30 inches apart each way, about 7,000 plants will be required per acre. It will help to give them a start, if the roots are dipped in a thick puddle, consisting of a mixture of soil and artificial manure, with only sufficient water to render the mixture adhesive. As a rule, the holes are best made with a dibber, and care should be taken to put the plants in perfectly straight. If the roots are doubled up, ill-formed specimens will be produced, or the plants may fail altogether. The soil must be closely pressed round the neck of the plant as a finish to the operation. The ground should be kept free from weeds, either by hand-labour or the horse-hoe.

Feeding value.—Analyses show that the cabbage family contain nourishing constituents to the extent of 6 per cent. of carbohydrates, over 1 per cent. of albumen, and very little fat. The stalks are richer in these elements of plant-food than the leaves; also, that young plants are more nutritious than old plants; the outer leaves are better food than the inner leaves or hearts; and, weight for weight, the open-leaved varieties (kales) are preferable to the hearting cabbages. It has been proved by experience that cows increase their milk wonderfully when fed with Thousand-headed Kale."

The following is an extract from Mr. Russell's paper:—"Thousand-headed Kale is the least known and most desirable of any green crop I have ever seen. It is a plant that produces more feed per acre than any other, does not disagree with any stock, and does not impoverish the land. With me it has never caused sheep or lambs to blow or scour. Eighteen perches per day, with a little oat straw, have kept 270 sheep for three months, without the loss of one."

The above article is from the pen of Mr. Fred. Turner, and appeared in the 3rd Vol. of the *Agricultural Gazette.* I have also had wonderful results in South Australia, Victoria, and at the Hawkesbury, in the cultivation of this most valuable, though little known, fodder plant.

The late Mr. T. N. Grierson, manager of the Bodalla Estate, reported splendid results from Thousand-head and Jersey tree Kales at Bombala.

Professor Lowrie, of the Roseworthy Agricultural College in South Australia, situated in a poor portion of the South Australian mallee country, with only a 16-inch average rainfall, produced 25 tons per acre of this fodder. He states he has tried many fodders, but none have done so well as the kale, and strongly recommends it in all dry districts. It is relished by all stock, and is specially good for dairy cows, sheep and pigs. The seed should be sown at the rate of 4 lb. per acre, in drills 3 feet apart.

Mustard.

Mustard, *C.V.O.* *Cruciferous.* Botanical genus *Sinapis.* Europe, Africa, Asia. Two species cultivated. *Sinapis Alla,* White Mustard; *Sinapis nigra,* Black or Brown Mustard.

The first is extensively grown for forage or green manure, while the latter is grown for seed. Mustard likes a free loamy soil. Quantity of seed per acre, 1 peck; weight of seed per bushel, 50 to 56 lb.; 75,000 seeds in a lb.; average produce of forage per acre, 10 to 15 tons; average produce of seed per acre, 30 to 50 bushels. Often sown when turnips fail. The seed is ground down to make ordinary mustard for table use. Worth 12s. 6d. to 15s. per bushel.

It is much grown as a catch crop and green manure. It is one of the quickest grown of all plants.

It is often ploughed in before wheat, as it has been proved to be obnoxious to the wire worm.

Mustard taken internally is a stimulant, a diuretic, and in large doses an emetic. For store sheep white mustard is a most valuable catch crop as it will give good feed in eight or ten weeks after sowing. It should be especially valuable for sowing immediately after a drought has broken up to give an early bite to starving stock. The tonic effects of mustard when fed to sheep present one of the salient features in the benefits of using it. Although very fresh and green, yet it does not scour the lambs or ewes. It has, in fact, exactly the opposite tendency, and may be employed as a corrective. Mustard will not fatten like rape, but will keep sheep in good store, healthy condition, and gives them a ravenous appetite, and so induce them to devour fodder they would not otherwise look at. It should be fed in conjunction with other fodder.

The success in establishing good crops of the three fodder plants under notice depends on deep cultivation and thorough pulverization of the soil, the selection of good seed, and rational treatment of the crop afterwards.

Prickly Comfrey.

Prickly Comfrey *(Symphytum asperrimum)* is now extensively grown, especially in England, as a fodder plant, both for horses and cattle, and is noted for its mucilaginous produce and emollient properties.

It is a perennial plant, and produces a most useful and profitable crop. It is relished by all animals, horses being frequently kept through the winter on it, without hay, and only a moderate allowance of oats, which has the effect of giving them a fine coat of hair.

When given to cows, it not only produces a full yield of milk, but the butter made possesses the quality and natural rich colour of the best summer butter. Young cattle also thrive well upon it, with or without turnips. Should cattle at first be found not to take it readily their dislike to it will probably be caused by the roughness of the leaves; for this reason they should be withered before being given.

Previous to use, it is necessary to put the Comfrey through a chaff-cutting machine, along with some hay or straw, so as to cut it into short lengths. Mixed in equal quantities, two pecks, morning and evening, is the allowance that ought to be given either to horses or cattle, with a moderate allowance of other food; when a little salt is added they will relish it better, and will thrive well on it.

Comfrey is propagated by cuttings of the root, or crowns, like horse-radish sets, and may be planted at any time except during hard frosts, or when the land is otherwise not in working condition, it being one of the most hardy plants cultivated; but the spring is undoubtedly the best time for planting. It will grow well on any soil except chalk. The distance at which the sets should be planted depends upon the depth and richness of the soil. In a well-trenched, rich soil lines 3 feet apart, and sets 2 feet from each other, will be a proper distance; but on light or poor land they may with advantage be set much closer. The ground should be prepared in the ordinary way for any crop, by digging and manuring. When properly levelled a line strained across the ground, and holes dibbled 2 or 3 inches deep, about 2 feet apart, and the sets placed into them, and covered up 1 inch underground, like planting potatoes, is the proper and simplest way of planting. Once planted it will remain for any number of years, and only requires keeping clean and heavily manuring to produce 80 to 100 tons of fodder per acre per annum.

The simplest way of manuring is to burn the last crop of the season, the ashes of which will form an excellent manure, and young shoots will spring out early the following spring.

Comfrey should be cut when it is about half grown, as stock like it better then, and it springs up again quicker; besides, when cut at that time, four or five crops may be taken in one year. If cut before the flower-buds open, it should not be cut closer to the crown than 2 inches. It is usual to reap it with a sickle, the crop from one root being as much as a man can get his arm round when set close. However, it may be mown with a strong scythe.

When an increase of sets is required for extending its growth, the simplest way of obtaining these is to take up a few plants, and carefully divide the roots with a sharp knife, so as to have sets each with a single crown.

An imperial acre of well-grown young Comfrey which is regularly cut will keep four or five horses or cows during the winter and early spring months with very little assistance in the shape of hay or roots.

The proper kind of Comfrey to cultivate is *Symphytum asperimum*, or the Caucasian variety. It is a native of Caucasus, and introduced into England from Asia about the end of last century. This is one of the most productive and nutritious varieties, and yields from 70 to 80 tons of forage an acre per annum, according to soil, and grows from 3 to 4 feet high, and bears bells of a whitish yellow or straw colour. True Caucasian Comfrey (*Symphytum asperimum*) has a large rough leaf, with a number of prickles on the under surface; hence its name, "Prickly Comfrey."

The plants should be set out a yard apart each way, which will, of course, take 4,840 plants for an acre. When once planted they will remain for any number of years, and will only require keeping clean and manuring to produce from 100 to 120 tons of good fodder per acre per annum. The cultivation of Comfrey, under any circumstances, is very simple; but where it is intended to have a permanent "Comfrey meadow," seeds might be sown along with oats, after a well-manured root crop, at the rate of 6 lb. per acre. As Comfrey will grow on the poorest of land, it would undoubtedly be the most profitable crop for waste lands, and will yield food for an additional number of cattle where formerly such parts of the farm yielded little or nothing. I have grown Prickly Comfrey in South Australia, Victoria, and this Colony with invariable success. In South Australia the results under irrigation and intense culture were highly satisfactory. It makes splendid ensilage, the prickly nature of the plant disappearing while undergoing ensiling in the silo.

Saving the Straw after the Stripper.

Mr. J. J. Piper, of Abercarne, Hallsville, Tamworth, writes:—"In the July number of the *Gazette* Mr. J. L. Thompson says: The practice of burning stubble cannot be too strongly condemned,' and that 'wheaten straw saved in the best condition, cut up into chaff and fed to stock, with a little grain or molasses, will keep them in good heart and condition during periods of drought.' I have no doubt Mr. Thompson means that we should provide stacks of straw for our stock by way of cutting the wheat before it is quite ripe, stooking it, then stacking it, and afterward threshing it. Well, I have no doubt that is the way to get straw in the best condition; but this involves a lot of labour and expense, and I have no doubt that is the reason why more straw is not provided for hard times. Some few years ago I adopted, and have continued, a middle course, between cutting and threshing the wheat and burning the stubble—that is to say, I cut the straw after the stripper. In the winter of 1895 I lost several head of cattle, which died of starvation. I then decided never to burn all my straw again unless I had stacks in reserve. Before harvest I divide the paddocks into blocks, or, rather, pairs of blocks, by cutting tracks through the paddocks. The wheat cut in making these tracks is made into hay. The blocks are made, say, about 10 acres each, or whatever size the stripper will be likely to go all around. When I start stripping I fix the winnower at one end of the paddock, and between two blocks. The stripper then goes round one of the blocks, and as it comes off that block to go to the winnower to empty the reaper and binder, goes on to the block the stripper has just left. Now, when the stripper has been emptied it goes on to the other block; thus while the stripper is going round one block the reaper and binder is going round the other. Changing every time, we get to that end where the winnower is fixed. Cut in this way the horses never trample on the straw, and the sheaves are as well made as if the stripper had never been over the crop. I believe there are made now some reapers and binders that work on the right-hand side the same as the strippers do. With one of those one could follow the stripper wherever it went, so that there would be no necessity to cut the paddocks into pairs of blocks; but I do not think that a reaper and binder going the same way the stripper has gone would cut the straw so clean as one that goes against the way the stripper has gone. The sheaves are flung by the reaper and binder clear off the track of the stripper. They need no stooking, but can be carted straight to the stack. The straw does not seem to be of much value at harvest time, when there is plenty of feed about for the time being. We have then some hay we have just made, and the stubble paddocks to turn the stock into. But we view the straw in a different light in the cold wintry weather, when the stock have nothing but the grass paddocks, and with very little grass in these to bite at. My stock have this past winter come to the straw-yard every night as regularly as the sun went down for their feed of straw, and they simply get the sheaves of straw as it comes out of the stack; it is neither chaffed, nor anything added to it. My stock like the straw from White Tuscan wheat much better than any other straw I have had, and I see Mr. Farrer speaks highly of White Tuscan as a hay wheat."

Agricultural Experiment Stations.*

DR. P. H. ARMSBY,
Pennsylvania Agric. College.

IN complying with the provision of our constitution which requires from the retiring President an annual address, I assume that the intentions of the Association, as well as the dictates of ordinary prudence, require that the subject of that address shall be one concerning which the speaker may at least be assumed to have some direct personal knowledge. I shall make no apology, therefore, for directing your attention almost exclusively to certain aspects of the experiment station movement.

I feel, too, that there is a certain special pertinence in such a theme on this occasion. Since our last convention we have been called to mourn the loss of one who, to his high and rare qualities as a man, a citizen, and a statesman, added a special claim to our veneration and love through his life-long identification with the interests of the institutions which compose this Association, and which owe their origin to the statesmanlike act bearing his name. At another time, and through abler and more eloquent lips than mine, this Association will put on record its estimate of his life and work, but I should fail to worthily fulfil the duties imposed on me by your kind partiality did I not take this first opportunity to publicly express in the name of the Association our sense of indebtedness to the wise counsel and unfailing support of the Honourable Justin S. Morrill, and our feeling of personal bereavement at his loss.

The institutions which Senator Morrill was instrumental in founding were to be educational institutions. Their function, as prescribed by the organic act on which they are based, is "The liberal and practical education of the industrial classes," and the eloquent address of my predecessor at the Washington Convention gave to all who heard it a new and more vivid conception of the importance and dignity of the institutions here represented as centres of liberal education—as instruments for the training of the scholar. It seems not inappropriate, therefore, to inquire what relation the agricultural experiment stations which have been attached to these institutions bear to their fundamental purpose, and to reflect for a few moments on the Experiment Station Ideal. Should the theme seem an ambitious one, and its treatment inadequate, I venture to hope that at least the subject itself will appeal to your interest, and arouse reflections which may be more profitable than the words of the speaker.

*Presidential Address delivered before the Association of American Agricultural Colleges, Berkeley University, California, 7th July, 1899.

The system of agricultural experiment stations, which now extends over the whole civilised world, is largely traceable to the influence exerted by the writings and investigations of Liebig.

This distinguished investigator, about 1840, when at the zenith of his powers, and after his discoveries in the field of pure chemistry had given him a world-wide reputation as a scientist, turned his transcendent genius to the study of those questions of plant and animal nutrition which lie at the foundation of the art of agriculture. It is true that others before him had sought not without success to apply science to agriculture, but the increased knowledge of organic chemistry which Liebig's own investigations had done so much to bring about, and the methods of investigation and analysis which he had perfected, had put new tools into the hands of the investigator and had prepared the conditions for a phenomenal advance.

Liebig's work marks an epoch in the history of agriculture. The breadth and grasp of his conceptions, no less than his clear and forcible style, enabled him at the same time to lay the foundations of the new science of agricultural chemistry, and to arouse popular interest in its practical applications, with the result that a popular movement was started, which culminated in 1852 in the establishment at Moeckern in Saxony of the first State Agricultural Experiment Station. Henceforth agriculture was to share with other callings the benefits of scientific study and the vocation of the farmer was to begin to be assimilated to that of the scholar.

The grain of mustard seed planted at Moeckern less than fifty years ago has indeed become a tree. To-day considerably more than five hundred experiment stations, distributed through nearly forty countries and colonies, form a monument to the vitality of Liebig's ideas on which, as on our own domain, the sun never sets.

In their first inception, the agricultural experiment stations contemplated largely "practical" experiments. But little experience, however, was necessary, under the wise guidance of Wolff and his contemporaries, to show that further study of principles was an indispensable preliminary to their profitable application in practice. Almost from the start, the agricultural experiment stations, especially in Germany, the land of their birth, have recognised abstract research as one of the most important of their duties, and we to-day see the fruits of this wise policy in the fact that our scientific agriculture is largely founded on the researches of men like Wolff, Nobbe, Henneberg, Stohmann, the two Kühns, Märcker, Hellriegel, and a score of others in the German Experiment Stations.

But, notwithstanding all this, these same German Experiment Stations, which we have been inclined to look upon as mainly centres of scientific research, have been, to a large extent, practical in their aims; and fertiliser, feeding stuff, and seed control, field experiments, and variety tests, have absorbed a considerable share of their energies. The same has been still more true of other countries. Everywhere, the experiment station has been looked upon as a part of the machinery of the State for direct practical ends. It has been the farmer doing collectively through agricultural organisations, or through the State,

what he could not do individually, and his aim has been to protect himself from fraud, and to enhance the profits of his calling.

The early development of the experiment station idea in our own country, beginning with Johnson's work for the Connecticut State Agricultural Society and the Connecticut Board of Agriculture, from 1857 to 1875, and taking definite form in 1875 and 1877, in the organisation of the First American Experiment Station, was largely along the same lines. The first American stations were in fact fertiliser-control stations, and while other lines of work were added as opportunity offered, yet, in most cases their work was, of necessity, upon immediate practical problems. Up to 1887, stations had been established in more than a dozen States, and work similar in character, although not in name, was being carried forward in others.

With the passage of the Hatch Act, in 1887, the experiment-station movement entered on a new phase. Up to that time the majority of the stations had been independent institutions, patterned after the German model, and, speaking broadly, the conception of the experiment station, where it had not been simply that of the control-station for the detection and prevention of fraud, had been largely that of an institution occupying much the same relation to the farmer that the expert chemist bears to the manufacturer.

The Hatch Act accepted this conception but broadened it, and introduced a new element, by making the new stations departments of educational institutions. This was not a mere matter of convenience nor a desire to secure additional funds for these institutions. Doubtless both these considerations entered in, but underlying all was a profound—perhaps an unconscious—recognition of the fact that the agricultural experiment station, in its broadest and most fundamental conception, is an *educational* institution. I desire to emphasise this idea because it appears to me to be one of fundamental importance and one which should give tone and direction to all our thinking.

Not that the relation of the station to the farmer should be in any way ignored or belittled. The station exists for the farmer and not for the college and it is both legally and morally bound to recognise this relationship and to serve the interests of the agriculturist to the best of its ability in its own field. I simply desire to point out the true nature of that service.

Even in those more direct and obvious relations which appeal to the popular sense, the real business of the experiment station is to educate. Agriculture as an art and a business consists in so guiding and controlling the great natural forces that they may co-operate in the economic production of crops and animals. The true service of the station to the farmer, as I conceive of it, is to give him such a practical knowledge of these natural forces as shall enable him to control them for his own advantage.

Just as a locomotive engineer, in order to successfully and economically run a fast express or a heavy freight, must have some degree of knowledge of the mechanical construction of his engine and of the laws governing the action of steam, and then must add to this long experience in the practical application of these principles to the

constantly varying conditions of load, track, grade and weather, so the successful farmer is he who has acquired, whether through the schools or otherwise, some knowledge of the principles of his calling and then adds to this, experience and good judgment in their application. The function of the experiment station is not the impossible task of giving him receipts suitable to every conceivable emergency. Its business is to enlarge his knowledge of the natural forces which drives his farm as the steam drives the engine, and to teach him to control them instead of being controlled by them. It is not a device to save the farmer the trouble of thinking. On the contrary, its constant and insistent demand is that he thinks more. It can help him permanently and effectively only to the extent to which he can by such thinking digest and assimilate its help.

In brief, the real problem of the station is not to put a mass of information, however valuable, into the hands of the farmer, but to strengthen his grasp on principles and his ability to apply them intelligently. In other words, it is an *educational* problem.

The experiment station is something more than an agency to test fertilisers or varieties—to devise methods of killing bugs, or curing sick pigs—in short, an organisation to help the farmer " to raise more corn to feed more hogs, to buy more land to raise more corn to feed more hogs."

While we must beware of that intellectual snobbishness which looks down upon these practical results as unworthy the consideration of the scientist and scholar, yet it is equally true that the materialism which regards them as the final aim of agricultural experimentation, and which measures the success of the station in terms of dollars and cents is totally at variance with the spirit of a true college, and should find no place in an institution of liberal education. The true field of work of the experiment station is the farmers' mind, not his acres.

But the direct and obvious educational influence of the station on the farmer is of less real importance, as it seems to me, than its indirect services, and it is to these that I especially wish to direct your thoughts.

We are evolving a variety of methods and appliances for agricultural education. Starting with the agricultural college, we are developing secondary agricultural education in our short courses and dairy courses, and the demand promises to outrun the supply. The movement for the introduction of the elements of agricultural science into the rural schools is gathering head, and the normal schools are already beginning to react to the demand for qualified teachers. Within the last fifteen years, the system of farmers' institutes has had a most phenomenal growth, and the attendance upon these schools of the farmer must be reckoned by the hundreds of thousand, if not millions. The reading and correspondence courses are making a rapid and apparently healthy growth, and, if last not least, the agricultural Press has been almost revolutionised in its character within the last three decades, and has become a powerful instrument of agricultural education. Everywhere there is manifest the demand for more light. The farmers are awake—they are hungry and thirsty for knowledge.

This movement, once started, cannot go backward. I look forward confidently to the time when the agricultural college, as we now know it, will be but the cap-stone of a great system; to the time when the country boys and girls throughout their whole education, be it longer or shorter, from the kindergarten through the primary school and the secondary school to the college and the university, shall be trained in the observation of those processes of nature which surround them on every hand, but which now so largely appeal to eyes that see not and ears that hear not.

When that time comes; when every rural school is a school of agriculture and its work is supplemented by the farmers' institute, the agricultural Press, and the home study course; when, instead of counting our students of agriculture by the score or the hundred, we shall count them by the thousand or million; then we shall have risen to some adequate comprehension of the dimensions of this vast problem of agricultural education, and shall have made a long step toward solving the problem of rural discomfort by making farming an intellectual occupation.

But what shall all these people, young and old, be taught and who shall teach it to them? Where shall we find the fountain from which shall flow the stream of knowledge and inspiration which shall fructify and vivify this vast system and prevent it from becoming simply a teaching machine and our teachers mere pedlars of knowledge? We shall find it precisely where it is found in all systems of education—in that first-hand knowledge and familiarity with the subject which is gained by independent original investigation—that is, we shall find it in the experiment station. It is here that I see the high ideal and the great work of the experiment station. It is our agricultural university devoted to the advancement of learning—the promoter of investigation; the source, not merely of knowledge, but of inspiration for the whole organism. Nor is this simply a hope or a prophecy. I believe the attentive observer cannot fail to trace in the past development of our methods of agricultural education a powerful influence from these institutions, nor to recognise the indebtedness of the farmers' institute, the school of agriculture and the agricultural Press alike, both in matter and spirit, to the experiment station. In my judgment, the people have received far more benefit in this indirect and unconscious way from the stations than they have directly.

My thesis is, then, that the most important function of the American experiment station is that of an institution for higher education in agriculture—the organic head of our whole system, and that it should be supported and managed in the light of this fact.

It was natural that this view of the function of the American station should not be prominent at first. The conception of the station as an independent entity was well established and gave abundant scope for work. Besides, the agricultural courses in many institutions were weak and the interest in agricultural education throughout the country was comparatively languid and had first to be awakened by the work of the stations before any considerable field for their educational functions was afforded.

Moreover, in the early days of the stations, there was in many cases a not unnatural failure to clearly distinguish between station and college work, and governing Boards, and, even in some cases, college presidents, with but vague conceptions of the nature of an experiment station, were inclined to regard this new fund simply in the light of an addition to the revenue of the institution.

As a natural, though unfortunate, result, directors of stations came to occupy a more or less distinctly defensive attitude towards the college in an endeavour to preserve the Hatch Fund for what they regarded as its legitimate uses and so came to have a sub-conscious feeling that the interests of the college and station were more or less antagonistic. I think I may speak freely of this, because these things belong to the past—to the time of adjustment to new conditions and duties. The cases are very rare at present in which serious criticism on this score can be made. But the feeling that the work of the station is distinct and essentially different from that of the college—that the station is in the college but not of it—has to a degree survived. Station officers are, many of them, still inclined to regard the separate station as the ideal, and the connection with the college as a concession to circumstances.

It seems to me that the time has fully come to discard this notion, and to recognise the station unreservedly as an integral part of the agricultural college, with its own distinct and peculiar functions as an educational institution.

Let us not, however, mistake the nature of the educational work of the station. It is, from our present standpoint, and in its relations to the whole system of agricultural education, the work of *higher* education.

I fully sympathise with those who are feeling the pressure of that most insidious and plausible demand upon the time and energy of the station worker—the call for undergraduates' elementary instruction. While a certain proportion of such work appears to be unavoidable under present conditions, I believe that any large amount of it is incompatible with the most efficient station work. It demands different qualities and a different attitude of mind, and interferes with that free disposal of time and energy which is essential to original and fruitful research. It is a dissipation of energy which ought to be concentrated. As I have already urged, the experiment station, in method and spirit, is the agricultural university, the school of the specialist, the teacher of the teachers, the head and crown of the whole system. If this be true, how unwise from an educational standpoint to hamper and dwarf it by requiring work of a lower grade. In my judgment, the ideal experiment station should be as fully separated as possible from the details—the daily grind—of undergraduate instruction while retaining its general supervision and inspiration.

But I would do this, not to diminish the educational work of the station, but to increase it by assigning to the station its true place in the system. The investigator in most cases feels as a distraction the necessity of presenting a course of general lectures or conducting

text-book drill, but the presentation of the results of his special studies to those prepared to appreciate them, and especially the direction of the research work of assistants, graduate students, fellows, etc., can seldom fail to be both helpful and inspiring. Indeed, practically this is what every investigator who has an assistant is doing. The assistants in our stations are our university students. It is from their ranks that we shall recruit the growing army of teachers of all grades for the work of future years. How far beyond this the station can go in the way of receiving volunteer assistants, fellows, etc., is one of the problems of the future. It would seem entirely feasible, at a comparatively slight additional expense, to in this way materially increase the usefulness of the stations, both as investigating and as educational institutions, and the few attempts now being made in this direction will be watched with interest.

But whether much or little be attempted in this specific direction is after all a minor question. The essential fact is that the experiment station is now, and must be unceasingly in the future, through its publications and through the direct personal influence of its officers, the source from which the college professor, the institute lecturer, the editor, the public school teacher, must draw both the substance and the spirit of their instruction.

If the ideal which I have thus imperfectly presented of the experiment station as an educational agency is a true and worthy one, certain consequences follow, to two or three of which I may be pardoned if I call attention.

And first, this conception of the experiment station has an important bearing on the kind of work which it should undertake. I have tried to show that the educational work of the station is that of *higher* education—the education which comes from and through research. If this be true, and if the work of undergraduate instruction in the college is not the proper function of the station, still less does the work of primary and secondary education belong to it. It is not its function to distribute general agricultural information through its bulletins and reports. It is not called upon to aid directly in the introduction of nature studies into the schools or in the conduct of correspondence courses, nor to systematically attend farmers' institutes, nor, except incidentally, to act as a bureau of information.

I do not think I shall be seriously accused of any lack of sympathy with the various means which are being devised for bringing the results of science to the people. I bid them all God speed. Some of them seem to me to have promise of untold good, but it is an unfortunate and mischievous confusion of ideas which looks upon them and even officially designates them in station publications and State laws as experiment station work. The ideas of the general public regarding the work of the stations are hazy enough at best. Let us not add to their confusion. All these things are things of the utmost, perhaps of paramount, immediate importance, but they are not *station* work. They are all forms of teaching, and teaching is the business of the school and not of the station. The central idea of the station is research—the discovery and promulgation of new truth. It is, in the

language of the Hatch Act, to "conduct original researches or verify reported experiments."

The truths which the station seeks may, of course, be of different orders. When it determines that John Doe's fertiliser contains 3 per cent. of nitrogen, it, in a sense, discovers a new truth, the determination of which has its own educational value to the discoverer, and in so doing it is doing its proper work. When it engages in abstract scientific investigation and brings to light some hitherto unknown law or process, it is likewise discovering new truth which, because of its broader and more fundamental character, has the highest educational value; and in this, too, it is doing its proper work. But when it issues a compiled bulletin or holds an institute, it may be doing a work that is most valuable, but it is not doing its own work.

I am well aware that there is nothing particularly novel in all this. We have been told often enough that the business of the stations is to investigate, and the language of the organic Act establishing them has been quoted so often that it seems superfluous to repeat it.

Nevertheless, no one who has had even a slight direct contact with farmers can fail to see that what they need and what they call for is very largely just such general instruction in the elementary principles of agriculture and the related sciences. The questions that are asked at institutes, the letters that come to the stations, the popularity of bulletins of information, all put this beyond possible doubt.

It is not surprising, then, that when they saw the best agricultural talent of the country assembled in these stations, earnest and zealous friends of the farmer, perceiving plainly this urgent, immediate need, and perhaps misled by the language of the first section of the Hatch Act, should feel that right here was the first and most important work for these scientists—that their first duty was to answer this cry for information, even at the sacrifice of the investigating function. It is a plausible argument, and all the more plausible because the need is so real and so urgent. A counter argument from the letter of the law, or from the general conception of the experiment station as shown in its past history, is not of very great weight, and cannot very long prevail in the face of such a condition. What I wish you to see is that this specialisation, or, if you choose, this limitation of the stations' functions, is not an arbitrary or *ex cathedra* one, but is based on the nature of things.

It is just because of this demand that we should jealously guard the station against every encroachment on its true functions. We must protect it in its work of investigation, not so much because of the direct usefulness of its results to the farmer—at present they are perhaps not of as much immediate and direct value to him as instruction—but because this work is an integral part of our system of agricultural education; and if we destroy it, we emasculate the whole system. When we dry up the springs among the hills, the mills along the river will sooner or later cease to grind. It is in the educational function of the station that we find the true reason for holding strictly to the historical conception embodied in section 2 of the Hatch Act, and when we defend this conception against those who

would make of the station a school or a tract society, we are defending the highest interests of the farmers themselves.

Into the vexed question of abstract scientific investigation, *vs.*, "practical" experiments, I do not now enter. Each has its place. There is no innate antagonism between them, and neither need exclude the other. No high ideal worthily followed ever interfered with faithfulness to the humblest duties, and I do not fear that our stations will fail to follow Liebig's example of the devotion of high scientific attainments to ends of practical utility. Indeed, I fully believe that the station with the highest ideal of its functions will be the most efficient in those simpler and more prosaic duties which are a legitimate and proper and important part of its work.

The range of choice is as wide as the conditions of the stations are diverse, and each must solve the problem for its own environment. The essential point is, that the central idea of *research*—the discovery of new truth—be held too. When this is done, each station, in proportion to its abilities and opportunities, will bear its part in the promotion of higher education as well as confer direct benefit on the farmer, and so will worthily contribute to the advancement of agriculture. At the same time, I believe the same thing to be true within the range of station work which is true of agricultural education as a whole, viz., that the source of inspiration is from above, and that a certain proportion of the very highest and most abstract work possible is a most direct and almost indispensable aid to efficiency in more practical lines. Particularly does this seem to me applicable to the individual station worker. To do effective higher teaching, or to be efficient as an investigator of even "practical" problems, he needs to be a scholar as well as a "worker."

I am confident that even a little time each day spent in following out some special subjects to the utmost limits of human knowledge concerning it will prove the most profitable part of the twenty-four hours, not only to the man himself, in lifting his work above the plane of drudgery, but to his station as well. This leads naturally to a word as to the bearing of this ideal on the qualifications of the station worker.

If the function of the station is investigation, then the station worker should be an investigator. If he has the happy faculty of presenting the results of his investigations in simple and attractive form, so much the better; but he must first of all possess the ability to find something to present. A wise and experienced minister of the Gospel once said in my hearing that he had observed that a congregation would usually attend when the preacher gave them something to attend to. I think we may safely say that when the station worker produces something worth attending to he will secure an audience to attend to it, and that, mediately or immediately, it will reach the people and help them. He should have some practical acquaintance with farming—the more the better—in order that he may not waste his work on irrelevant or unimportant problems. But if he has only this, how is he superior to many of those whom he desires to help? Is he not a blind leader of the blind?"

Now, investigation does not, like reading and writing, "come by nature." It requires training—if you choose, it is a trade and requires an apprenticeship. The investigator must know how to ask questions of Nature, and be able to interpret her answers. In other words, he must be trained in modern scientific methods. No zeal nor facility, nor practical experience, can take the place of this. No matter how practical the end to be attained, the road to it lies through the rigorous application of those methods which have led to the vast scientific progress of the nineteenth century. No matter what else he is, the station worker must have a thorough scientific training, not for the sake of the knowledge which is acquired by that means, but for the sake of the power which it imparts.

And what of the officer who is to direct the activities of these various investigators? What are the qualifications for this important position? Is he to be simply an executive, presiding at the meeting of a council, dividing up the funds among the various departments, and looking after the business interests of the station?

So long as we take what may be called the business view of the experiment station—that view which regards it simply as an agency to accomplish certain practical ends for the farmer—so long we may answer this question affirmatively. If the station is purely or chiefly a business organisation, then it requires simply a business head. But if we accept the conception of the station as the head of our whole system of agricultural education, the case is quite different. If the real essential function of the station in this system is the promotion of original investigation, and if the prime qualification of the station worker is that bent of mind, and that scientific training which qualifies him to investigate, should not the head of the station have some personal knowledge through experience of what constitutes real investigation? This does not imply that he must combine in his one person the abilities of the chemist and the botanist and the entomologist, and so on through the list, but surely in some one line he should himself be a producer of the commodities of science.

In the combined attack on the domain of ignorance by the army of station workers, should he not say "come" rather than "go?" We have heard not a little in the past of the "director who directs." May it not be well to set before ourselves distinctly as an ideal the "director who inspires."

Finally, and very briefly, this conception of the experiment station serves to give additional emphasis to the exceedingly important idea of the unity of the interests and the institutions here represented. The institutions are not doing two distinct kinds of work, teaching and experimenting, but one,—education. This association does not stand for two parallel but distinct sets of interests. It is not an association of colleges and of experimental stations, but an association of colleges and experiment stations—of college stations, if I may coin a term to better express my idea. Its charter is as broad and comprehensive as that of the institutions composing it. Nothing that concerns any aspect of the great problem of industrial education is foreign to its

aims, and no single phase of this problem can claim any exclusive rights in its deliberations.

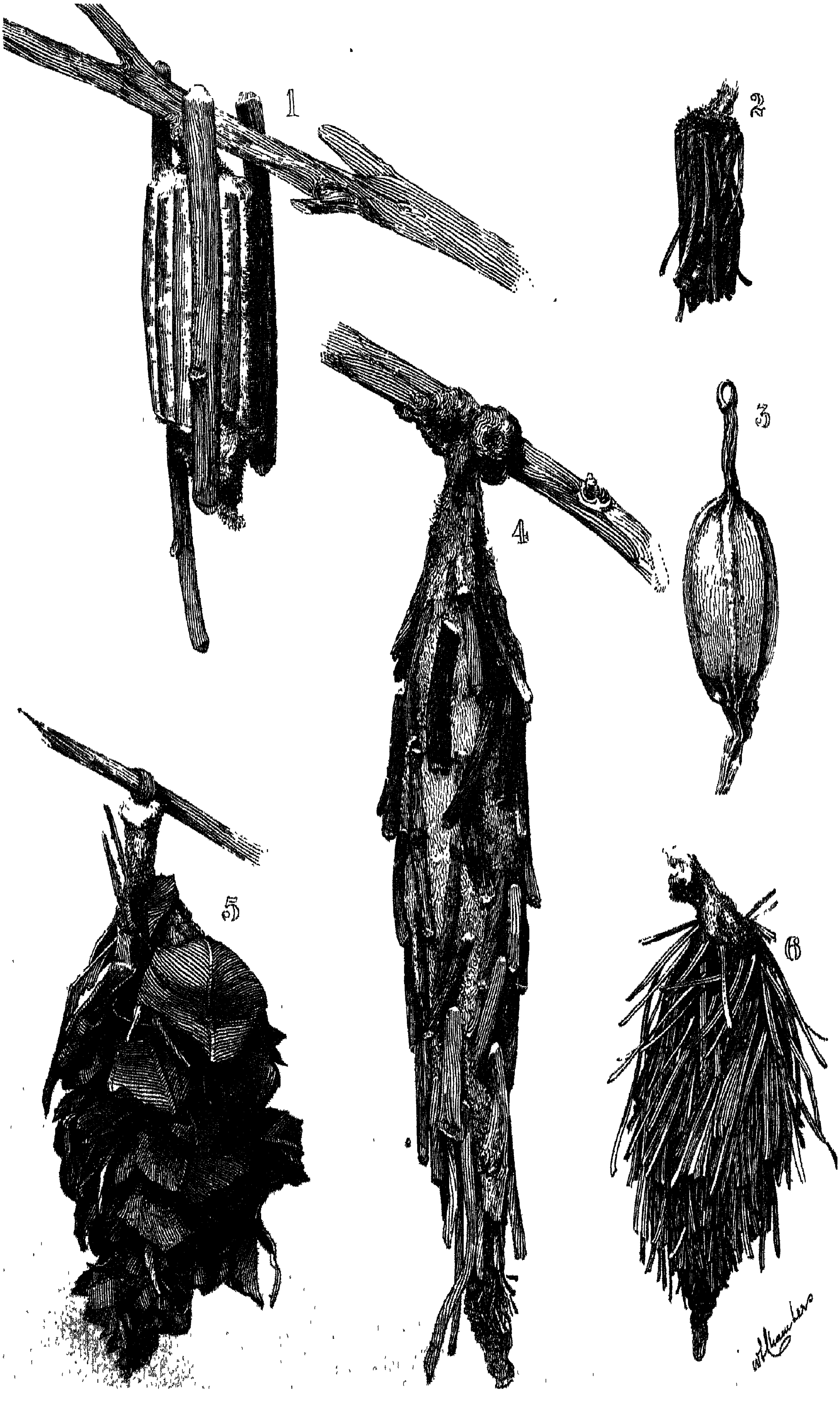
When it meets in annual convention, it is not for the sake of giving "station men" or "college men," chemists or engineers or botanists, agriculturists or entomologists, or even college presidents, an opportunity to consider each their separate affairs, but in order that we may all, according to the measure of our several abilities, take counsel together concerning the one grand work in which we are engaged. Whether the association consider executive matters or technical subjects, questions or legislation, or methods of teaching and investigation, whether it meet in general session or in sections, all is for the furtherance of one great purpose, and each is interested in all, because all is for the benefit of each. There may be diversities of judgment as regards means and methods; there can be no conflict of purpose.

So long as it continues to be guided by this thought, our association cannot fail to be, in the future as in the past, a most efficient and indispensable aid in the promotion of unity of conception, and harmony of methods, in all phases of our great work of "the liberal and practical education of the industrial classes."

Some More Good Results from Cow-Peas.

In a most encouraging report received from Bardon Bridge, South Grafton, Mr. J. Dethick says: "I have a piece of new ground (1½ acres), which is all pure sand. I ploughed and cross-ploughed it, then harrowed it down and struck drills 20 inches apart; manured with farm-yard manure and wood-ashes, and planted different varieties of cow-peas on 28th January, 1897. All came up well, and I cultivated them until the plants met in the rows. They soon covered the ground with a fine growth of vine. I cut them 22nd May, and dried and stacked them. Some I fed to the cows, pigs, and poultry; the remainder I threshed for seed. Then I ploughed in the stubble and sowed rye, which grew 7 feet high, and which gave a return of 14 bushels seed to the acre. I can strongly recommend cow-peas as a manurial plant for our light or poor lands."

Mr. Dethick does not mention which of the varieties he tried was considered the best, but from other reports, especially one by Mr. Dennis, of Turner's Flat, Kempsey, it appears that the Black Cow-pea, in that district at all events, grows most luxuriantly and produces the greatest quantities of seed and fodder.



AUSTRALIAN CASE OR BAG MOTHS.

Australian Case or Bag Moths.

By WALTER W. FROGGATT,
Government Entomologist.

Among that great order Lepidoptera, containing all the different groups of butterflies and moths, we find some possessed with such remarkable habits or instincts that they immediately attract the attention of even a casual observer, and this particularly applies to them in the caterpillar stage before they have developed into the perfect insect.

Some of you know that among the lace-winged insects (many of whose larvæ lead an aquatic existence, and crawl about in the mud and water weeds in the bottom of ponds) the caddis flies are remarkable for constructing curious little silken bags or tubes, smooth inside but outwardly covered with bits of sticks and stones in which they hide, carrying them about when feeding to protect them against their many enemies. The same reasons that have led to these soft-bodied creatures forming an artificial protective covering have prompted several species of moths to do the same.

Some of the *Tineina* have this habit, the well-known "Pistol-case Bearer" *(Coleophora malivorella*, Riley) and the "Cigar-case Bearer" (*C. Fletcherella*, Fernald) being well-known apple pests in America. Both species are tiny little creatures about ¼ of an inch in length, and take their popular name from the curious shape of their cocoons under which they feed, and on account of their small size are often unnoticed until they have done a lot of damage.

We have several species of the group in this country, some of which feed upon moss, on rocks and fences, and cover their cases so cleverly with their food-plant that as long as they remain stationary it is very hard to detect them; another species which might be called the "mimic case moth" *(Xystmatodoma guildingi*, Scott) makes a stout silken bag with a few bits of stick attached, and as it feeds upon the scrub might be easily mistaken for a true case moth.

It is with those belonging to the Family *Psychidæ* that our chief interest lies, both in the structure of the cocoons or bags and also of the perfect insects. In Germany they are known as "Sacktragers," with us as "Bag or Case Moths," and in America as "Basket Worms."

The *Psychidæ* comprise a number of very curious moths which are most plentiful in the warmer parts of the world, all of which make cases or bags in which they feed and crawl about with only the head and legs protruding; the claspers on the lower segments of the body clinging to the silk inside.

Two species are not uncommon in England. *Psyche fusca* covers its bag with leaves attached crossways to the bag, but *Psyche graminella*

forms a case about an inch in length covered with leaves, while *Psyche unicolor*, common in some parts of Europe, makes a case somewhat larger. About twenty species belonging to a number of different genera are recorded from India. America is also rich in these moths; Glover found one in Florida attacking the oranges, which was named after him by Say, under the name of *Platoecticus Gloveri*. Another American species is called *Psyche helix* because it covers its case with grains of sand, and is curved round so that it strongly resembles the shell of a snail (*Helix*).

New Zealand has two species, one of which (*Œceticus omnivorus*, Fereday) Hudson says is very common and builds a small bag not unlike one of our species; the second (*Orophora unicolor*, Butl.) is a rare species only found in one district; it clothes its cocoon with bits of grass.

This family is very well represented in Australia, and at a very early date their cases attracted attention, As long ago as 1799 "An Account of the Porcupine Caterpillar of New South Wales" was published in the "Naturalists' Pocket Magazine." Later on the well-known Tasmanian writer and artist, Mrs. Meredith, in her book, "Notes and Sketches of New South Wales," gives a general account of their habits. In a paper by Professor Westwood, published in the "Proceedings of the Zoological Society, 1854," he grouped all our species under the genus *Oiketicus*, and described and figured most of our species.

The late Professor M'Coy devoted some space to several of our largest species in the "Podromus of Victorian Zoology." Mr. C. French has described Saunders' Case Moth as a pest of the vine. The late Mr. A. S. Olliff, in one of the earlier numbers of this *Gazette*, described the Leaf-case Moth (*Thyridopteryx Hubneri*, Westw.) as the "Pine-case Moth," on account of its habit of feeding upon the foliage of *Pinus insignis*.

General Description.—To commence at the beginning, the eggs in countless numbers are laid by the wingless imprisoned female (who never leaves her cocoon) at the lower end, and as soon as they hatch—generally within a few days—the young larvæ eat up the shells, and then frequently finish up by eating their dying or dead mother. They then make their way out through the lower end of the bag, each clinging to a slender thread, and swarming out over each other in long strings of squirming black caterpillars. Almost as soon as they touch the foliage of their food-plant they commence to feed, spinning a little silken cap, which they cover with the rejected bits of their food, and all the time they are growing they keep adding to their bag and ornamenting it with bits of sticks, leaves, &c, as their fancy suits them. At first the larva is somewhat exposed, but when it reaches its full size it is enclosed in a thick silken bag into which it can retreat if frightened, but when undisturbed it crawls about feeding with only the head and four legs outside the neck of the bag. When tired it hangs the house on to a twig with a silken strand and takes its ease, simply gnawing the strand through when ready to move on again. When at last the time comes, and the caterpillar stops feeding, it attaches the cocoon firmly to a twig with many silken strands, securely closing up the

opening; if the caterpillar is to turn into a male insect, it turns round in the silken chamber before undergoing its transformation into a chrysalid, so that when the time comes for it to break its chrysalid skin and emerge as a perfect moth it will have no difficulty in doing so through the open end at the tip of the cocoon. If, on the other hand, the caterpillar is going to change into a female moth, she remains in the old position, with the head pointing upward, and undergoes only a partial transformation, when she has cast the pupal skin. At the end of the season she has no wings, being equipped only with rudimentary legs and antennæ, and an immense, soft, cylindrical abdomen, which is simply a skin full of eggs, not unlike that of a queen white ant. As before noticed, after laying her eggs she dies without leaving the cocoon, but the male moth is a very swift flying creature, with strong wings more or less covered with scales, teethed antennæ (*bipectinate*) and a slender body which can be extended to a considerable distance when the moth wants to mate with the female. Some writers state that in several species the virgin female moths lay fertile eggs without the intervention of the male moth.

The following are the chief species of our case moths, described so as they can be easily recognised by any one who wishes to look them up:—

Saunders' Case Moth (*Metura elongata*, Saund.). [Fig. 4.]

This fine species was described by Saunders in the Transactions of the Entomological Society of London in Vol. V. p. 43. Westwood, later on, described it under the name of *M. Saundersii*, and proposed this instead of Saunders' name, as so many other species were named after eminent entomologists (Pro. Zool. Soc. 1854). This species is seldom seen in any great numbers, but single ones attached to trees, fences, and walls, are common all over New South Wales. It is also common in Victoria, South Australia, and Southern Queensland, probably ranging over the greater part of Australia. The cocoon is a stout, silken elongate cylindrical bag, tapering from the base to the centre, and then decreasing in diameter towards the neck; the outer surface is irregularly covered with short pieces of straight stick, gnawed off the food-plant and firmly attached to the silk of the bag by the larva, sometimes only by the tip, but at others by the whole length with only the lower end free, but those at the base of the bag generally hang past the tip of the bag. This is quite a formidable case to drag about with one, but the larva travels considerable distances with its house on its back.

The caterpillar, of which one sees only the head, thorax, and fore-legs, unless it is cut out of the cocoon, is a stout cylindrical creature, measuring 2 inches in length, of a general brown colour, the head dull reddish orange, and the thoracic segments banded with parallel bars of black and orange; the legs are very stout and armed with strong scaly claws.

The male moth, which is a very rare insect, measures under 2 inches across the outspread wings, the body when at rest, being about an inch in length, but it can extend the abdomen, which is telescopic,

fully another inch. The head and thorax are thickly clothed with bright reddish orange coloured down; the apical segments of the abdomen banded with hairs of a similar colour; the wings clouded and smoky, lightly clothed with fine scales.

One would think that a caterpillar so well protected from its babyhood with such a protective covering would be pretty secure from enemies; but this is not the case, and a very small percentage of the moths ever reach maturity. Numbers of parasitic ichneumon wasps deposit their eggs on the living caterpillar, which, after devouring the unfortunate creature, spin their little cocoons in its remains and emerge, sometimes a hundred or more coming from a single cocoon. Several of the larger Tachnid flies also manage to get their maggots into these cocoons, which soon make short work of the unfortunate caterpillar in a similar manner.

These caterpillars are seldom numerous enough to do much damage; but specimens found hanging on fruit-trees in orchards, where they eat the young foliage and bark, are constantly being sent into the office.

The Ribbed Case Moth (*Thyridopteryx herrichii*, Westw.). [Fig. 3.]

This one differs from the others in not covering its bag with any outward ornamentation. It is not a common species, but single specimens may be found about the Sydney bush, generally upon the young bloodwood trees (*Eucalyptus corymbosa*), where they feed in just the same manner as the others. The cocoon is composed of stout white silk, and measures on an average 2 inches in length, consisting of a slender neck, swelling out into an oval bag, three-quarters of an inch in diameter, regularly angled on the sides, so that it forms five ridges, with the space between flattened, so that the case is really five-sided. At the apex it comes to a distinct point, below which is an attenuated wrinkled tail of silk hanging down, through which the male moth and freshly-hatched larvæ can crawl.

The grub is blackish-brown, with the head and first thoracic segment lighter coloured, and the second thoracic segment mottled with brown. The moth has the head, thorax, and body thickly covered with black hairs, a reddish orange spot behind the thorax, and the antennæ large, pectinate, and black. The wings measure about an inch across when spread out, and are membranous and semi-transparent, with only the inner margin of the hind pair clouded.

The Faggot Case Moth (*Entometa ignoblis*, Walk.). [Fig. 1.]

This moth was described by Walker many years ago, and has since been figured and described by the late Professor M'Coy in his *Podromus of the Zoology of Victoria*, and has a wide range over Australia. It is variable in size, and it is more than probable that when they come to be carefully worked there will be several species with a somewhat similar style of travelling bag. The larger ones are seldom found in our orchards, but what I believe to be the immature form of this species has recently developed a peculiar habit which is very annoying to the owners of cherry orchards. Mr. A. Manson, of Goulburn, who first called my attention to this habit, says that when

they appear in any number the loss is considerable, for the young case-weavers always line the outside of their bags with straight sticks, and they have found that the long stalks of the half-grown cherries are just the right length; so they set to work, cut off the cherry, then gnaw off the stalks at the base and attach to it the side of the cocoon. As each case takes over twenty-four cherry stalks, one can understand what mischief a small family of these busy little creatures can do on a cherry-tree. [Fig. 2.]

Of course it is very easy to find when a cherry-tree is infested with these little pests, as the cherries detached from their stalks are scattered all round on the ground beneath; and a timely spraying of Paris green would bring the moth larvæ down in a similar manner. In the bush these caterpillars confine their attacks to the foliage of the gum-trees (*Eucalyptus*), and coat the outside of the bags with the gnawed sticks of the branchlets.

The fully developed cocoon is a cylindrical silken bag up to 3 inches in length, including the short neck and tail; round this bag is fastened a solid fence or coat of stout sticks, gnawed off the food plant. The tips of the sticks are irregularly placed, with one and sometimes two sticks projecting as much as a couple of inches beyond the edge of the cocoon and the ends of the other sticks. The sticks are laid parallel to each other, fastened close to the sides of the cocoon from end to end. This form suggests a strong resemblance to a bundle of sticks, so that M'Coy when describing it called it the "Lictor Case Moth," because it resembled bundles of sticks carried by the "lictors" (personal attendants on the Roman emperors when they were travelling); but I have proposed the "Faggot Case Moth" as much more recognisable and appropriate for their stick-encased cocoon than the name suggested by Mr. M'Coy.

The caterpillar is a stout, rounded creature, of a uniform brown colour, with the head and thorax of a creamy white spotted with black. The male moth measures about $1\frac{1}{4}$ inch across the wings, with a body about three-quarters of an inch in length, and is of a uniform brown colour; the head, thorax, and abdomen covered with ochreous coloured hairs; the wings lightly covered with scales towards the tips, and a darker spot in the centre pair.

The Leaf Case Moth (*Thyridopteryx Hubneri*, Westw.).

This is our most widely-known species that, though originally confined to the foliage of the gum-trees (*Eucalypti*), *Leptospermum* and other native bushes, it has within the last few years found its way into our gardens and orchards, where it is almost omnivorous, eating anything that comes in its way; and when an adult female has weathered through the winter and brings forth her countless brood, they soon scatter all over a bush or plant and riddle its foliage with holes. In the nurseries they often attack the chrysanthemums; in the orchards they are more common on apple-trees or vines, and as before noticed have a great liking for the foliage of *Pinus insignis*. Two seasons ago it attacked all the oak-trees at Parramatta. The silken bag formed by the young larvæ

commences as a little conical cap of brown silk covered with minute scraps of the leaves upon which it is feeding ; as they increase in size the bag becomes more elongated and hangs down behind the little caterpillar, when at first it was upright immediately above the insect. The bag always grows with the caterpillar, and as it increases in size and strength it attaches bigger pieces of leaf to the outside of the case ; so that they keep over-lapping each other like the slates on a roof, except that they hang freely, being fastened only at the upper edge to the silk of the bag. When full-grown these silken bags measure up to 3 or even 4 inches in length, having a slender neck of about half an inch in length by which it is firmly attached to the twig; and below this neck it swells out into a stout silken bag about $1\frac{1}{4}$ inch across the centre, tapering thence to the tip. [Fig. 5.]

These cocoons are very variable in their outward clothing, on account of the different food plants—one feeding upon pine trees and thickly clothing its bag with pine needles having a very different appearance to one covered with stout gum-leaves; and those living on the tea-tree different again; so that an immense variety of different-looking cocoons could be found in a large series of specimens, though all formed by the same species of moth larvæ. [Fig. 6.]

The caterpillar is a very stout, black grub, about an inch in length, with the head and first two thoracic segments dull white, mottled with dark brown, the edges of the thoracic and tip of the abdomen marked with dark reddish-brown.

The male moth is a pretty little creature, thickly clothed with black hairs, reddish-brown antennæ ; the wings seem transparent, with an opaline tint, with a blackish patch on the hind margin of the second pair.

The case of this species figured by Westwood is a variety in which the bag is covered with slender *Leptospermum* leaves, but he also figures another, our typical form, covered with pieces of gum-leaves of which he does not know the maker. Another doubtful form he figures without description, constructed of silk with bits of silk stuck on crossways, probably not a true case-moth. Lintner has described an American species (*Thyridopteryx ephemeræformis*) allied to ours, which is very destructive to arbor-vitæ and other shade trees in the State of New York.

Lewin's Case Moth (*Olania Lewinii*, Westw.).

This species is figured and described by Westwood, and is a typical form of the "Faggot Moth," with the stout sticks attached closely together right round the cylindrical silken bag, his figures showing the one stick projecting beyond the others, which is generally the case in a perfectly formed specimen.

Boisduval's Case Moth (*Thyridopteryx Oiketicus Boisduvalii*, Westw.).

This is a slender elongate oval case, about 2 inches in length, thickly covered with short bits of stick closely attached to the silk, so that it is quite stiff. The larvæ feed upon several species of low scrubs about Sydney, but are not so noticeable as the other and larger species.

Macleay's Case Moth (*Oiketicus Macleayi*, Goulding).

In Westwood's paper the species is redescribed, the locality given being the West Indies; but in *Walker's British Museum List* the habitat is given as Australia.

Other Species.

Walker has briefly described the moths of four other species of *Entometa*, and another under the name of *Panisa circumdata*, from New South Wales, in his British Museum Catalogue, 1854, but does not record anything about their habits.

In the last number (1899) of the *Linnean Society of New South Wales*, page 83, Lowes describes a new species from Queensland under the name of *Oiketicus ulias*.

Remedies.

Case moths are not difficult to deal with if a place is well looked after; for at the pruning season it is very easy to see the adult cases hanging upon the trees or plants, and if these are collected and destroyed there will be no thousands of hungry little larvæ crawling over and devouring the foliage when the summer comes. When a tree shows signs of suffering from their attacks, a spray of Paris green will soon destroy them.

Bibliography.

The following is a list of the most important papers dealing with Australian Case Moths (Family *Psychidæ*) :—

(1) The Naturalist's Pocket Magazine, Vol. I, pl. 18 (1799). "The Porcupine Caterpillar of N.S. Wales."

(2) Notes and Sketches of New South Wales. Mrs. Meredith.
Gives a general account of their cocoons and figures of five different cases.

(3) Lansdown Guilding. Transactions of the Linnean Society. Vol. XV.
Describes several species of the genus *Oiketicus*, among them *Oiketicus Macleayi* from Australia.

(4) Saunders. Transactions of the Entomological Society. Vol. V, p. 43.
Description of our large case moth with *Oiketicus elongatus*.

(5) I. O. Westwood. Proceedings of the Zoological Society, 1854; pp. 219-243, Pl. xxxiv-xxxvii.
Descriptions of some new species of Lepidopterous insects belonging to the genus *Oiketicus*. He describes and figures in detail most of our large species, and others from Ceylon and the West Indies.

(6) T. Walker. British Museum Catalogue (*Lepidoptera-Heterocera*). 1885. p. 972.
List and description of new species of these moths.

(7) F. M'Coy. Natural History of Victoria. Decade IV, p. 41, pl. 40. "Case Moths."
Gives descriptions of *Metura elongata and Entometa ignoblis* with coloured drawings.

(8) A. S. Olliff. *Agricultural Gazette* of N. S. Wales. 1891. Vol. II, p. 349. (One plate).
Entomological Notes. The Pine Case Moth (*Oiketicus Hubneri*). An account of the larvæ destroying pine trees.

(9) C. French. Handbook of the Injurious Insects of Victoria. 1893. Vol. II, p. 76, pl. xxv.
Gives a general account of *Entometa elongata*. "The case moth of the Orange."

Bees, and How to Manage Them.

ALBERT GALE.

UNDOUBTEDLY the three most important allies to a bee-keeper are eyes that are keen to observe small movements, ears quick to detect the tones and semitones made by the wings of the bees, and fingers very sensitive to touch, and nimble enough to adjust, swiftly but gently, frames at the required distances, or to change those spaces as circumstances may require. The last-mentioned faculty is, perhaps, the most important of all, and the novice will learn from experience that much of his success will depend upon the dexterity and discretion he is able to exercise in the manipulation of his frames.

Somewhere in his *Complete Angler*, old Izzac Walton says, in referring to putting a worm on the hook, "Handle it gently, as though you loved it." That is the most essential advice I can give to any who want to know how to become a bee-master. Be kind, be gentle. Gentle in all your movements. Kind in moving the bees from place to place. What queer ideas onlookers have as to the reason why a practical bee-keeper is so successful in handling his bees, and the extraordinary notions these onlookers entertain as to the docility of the bees when under manipulation. "Oh, the bees know him," or "He has chloroform about him," or, "He puts something in that smoker (the bee-bellows) that stupefies the bees," are some of the ejaculations that I have overheard again and again when giving practical lectures on "How to handle bees." If I were giving my experience under this head, many amusing and interesting circumstances could I relate that bee-keepers themselves would hardly give credence to. An experienced bee-keeper does not handle his bees with that apparent nonchalance because he is assured of the fact that his bees know him. How can it be so? Look at the thousands of inmates in a hive. How can the individuals in that community become acquainted with their keeper? No, it is not that the bees know their master, but that the master has a knowledge of his bees. He knows by certain of their movements, their appearance, and tone (perhaps I had better say voice), how far he can go, and no farther. We must remember the duration of the life of a working bee at the time they need handling is only about six weeks. We know the length of time required for the most docile of wild animals to become acquainted with their keeper; and the pugnacious nature of the whole race of bees does not except them from the catalogue of the untameable. Nevertheless, the handling of generation after generation of bees, and the breeding from queens of known docility, is telling upon the retaliatory disposition of the bees. That, combined with our increasing knowledge of bee-life, is no doubt having its effect upon their disposition.

I tried chloroform once in my early days, acting on the advice of a chemist. Do not ask me to give you my experience. I would rather not. Smoke from the bee-bellows does not act in any way upon their nerves, other than compelling them to gorge themselves with honey.

The bee-master, from the movements of the bees, knows by experience when he can handle them successfully. Again, bees have a language that can be interpreted by a practical bee-keeper as easily as the language of the poultry-yard is understood by the hen-wife. What poultry-farmer does not know the call of a hen when danger is nigh, or when she is looking for a nest, or when she has laid an egg, or when she is about to sit, or when she has chickens, or when she has found a tit-bit for them, &c., &c. So bees have a language that is as distinct to the practical ear of a bee-master as the calls of the farm-yard are to the ears of a farmer.

The joyous, natural note of bees when they are flying from flower to flower, there are very few who cannot recognise it. By that same note the bee-keeper knows when his pets are returning home that they are peaceful and happy. When that note changes sharp and shrill, it is the war cry; then he retires if he has discretion. If, when he has blown a little smoke in amongst his bees, there is a dull, heavy sound, he knows it to be the cry of defeat. He knows, too, their cry of distress at the loss of their queen, and the ecstatic cry of joy when she is returned. Try it with a swarm of bees that is queenless, and without brood, by putting in a frame of brood-comb containing larva and eggs—at once they change their note to one of joy. What a melodius note they give forth when rising on the wing to swarm; how it changes when they have found a suitable place whereon to alight; then the rallying call to the fugitives as they cluster in thousands one upon the other, and how that cry gradually subsides as the wanderers return to the cluster. When all the swarm has returned to the alighting spot not a sound is produced. Then, again, listen at a hive at the close of day, when they rest from their out-door labour—the exhaustive labour during the honey harvest. As they stand with their rapidly vibrating wings expanded fanning and ventilating the hive, what a peaceful sound they emit as they sing their evening doxology, "Praise God for Whom the honey flows." These are sounds that must be learned, and can only be learnt by experience; every bee-keeper knows them. Perhaps not in the order and the language that I have employed, but he knows their change of tone under different circumstances and conditions.

When examining a hive do not stand in front of it. Stand at the side or, better still, behind. In the article on the arrangement of the hives in the apiary I have already cautioned you to have the hives sufficiently far apart from row to row to give the bees room to enter their home without your presence interfering with their direct line of flight. Stand by a hive of bees and watch them going out to their field labours, and returning with the spoils of the trip. On going out, especially if the honey flow be in trees generally surrounding your homestead, after they emerge from the hive they rise in the air, and

make many abortive attempts to go in as many different directions in quest of honey or pollen. When they have decided, they at once hie away to where they can get the greatest quantity in the shortest space of time. Then watch the returning bees. Each one comes in a straight line from the last flower she rifled of its nectar, when she drops almost suddenly to the hive entrance. There is no hesitation. She enters at once, eager to disburden herself of her load. If they are coming from any point in a direction fronting the hive, their line of flight between the last flower wrought upon and their home is a direct one. Keeping rather high in the air, until near the hive, they gradually descend, forming an inclined plane to the entrance. But, if the foraging ground be somewhere away to the back of their home, they keep at about the same altitude till they get a little beyond their home, when they drop suddenly to the entrance. If bees are interrupted in their line of flight by an animated object near the entrance to their home, they are at once angered. If you stand in front of that line you become that object, and the bees will resent it upon you; but if you take up a position at the rear, the bees, in their homeward flight, pass over you, and you stand on very safe ground. Now you know where to stand, when you are about to handle your bees, and the reason of it.

The time to examine your bees must be guided by the season and circumstances. In the summer season, any time, if the day be bright; but the middle hours of the day are the best, because there are not the number of bees at home as there are in the earlier or later ones. In the colder seasons never open your hives except under very exceptional circumstances; then select a bright day about noon.

Charge your smoker with anything that will smoulder, and at the same time will throw off a fair volume of smoke, but will not ignite into flame. Old, semi-rotten bagging, old fustian, dry cow-droppings, or cotton-waste that has been used to clean the oiled parts of machinery. There are plenty of other things that are equally good. When the contents of the smoker is lit, see that it smoulders well. First, remove the lid of the hive gently and quietly; next, turn back one corner of the quilt so as to leave a small aperture in that opening; blow in two or three puffs of smoke, keeping the nozzle of the smoker about six inches from it, so that heated smoke shall not reach the bees. I have more than once seen the wings of bees singed for the want of taking this precaution. Wait two or three seconds after this for the bees to well gorge themselves with honey. It is this gorging of themselves with honey that subdues them, not their knowledge of you, not smoke that stupifies them. After the lapse of a few seconds, gradually and slowly peel off the quilt. You will find it adhering to the frames rather firmly, especially if it be some time since the bees have been examined. As you peel it off, follow it up with a good cloud of smoke, still keeping the nozzle well back from the bees. When the whole of the frames are exposed, or as many of them as may be required, just look at the bees, some of them will still have their heads in the cells sucking up the honey; others will be walking rather leisurely over the surface of the comb; others, again, forming little clusters here and there. Those bees on the frame will appear rather longer in the

abdomen than those that are coming out of a hive near by that has not been so disturbed. The dorsal rings of the abdomen of bees when surcharged with honey are distended one from the other by a little whitish ring between each of the plates, six in number. When these whitish rings are visible, the bees are on their best behaviour; their hum is peaceful and quiet. No more smoke will then be needed, except when necessary to drive the bees from one place to another. If, on the other hand, the bees on the comb are restless, some of them standing as if on stilts, their abdomens rapidly vibrating to and fro, occasionally protruding the sting, and those on the wing uttering a sharp, shrill war cry, it is just about as well to leave them alone if you are an amateur. An old, practical bee-keeper would not mind all that; he would very soon bring them to their senses, and go about his work as though they were on their very best behaviour.

Taking Bush Bees.

On the northern rivers of this Colony, back in the early seventies, bush excursions were frequently made in quest of bees' nests, and ofttimes it proved a very profitable pastime. Armed with a good axe, a knife, and vessels in which to carry home the booty, a party would sally forth, frequently with horse and dray, and come back with 2 or 3 cwt. of honey. True it was bush honey, that is, a mixture of rotten wood and what else the hollow spout contained. But what did that matter? Those who feasted on the luscious delicacy in those days knew nothing of a purer article, excepting that which went under the name of "garden honey." This article differed nothing from "bush honey" only there was no rotten wood in the mixture. More than once I have seen trees felled in which there were two nests, each containing upwards of 1½ cwt. of marketable honey, which was then sold at 2d. per lb. I have also seen a big, old, solid ironbark, the hollow spout of which contained a bees' nest, after a deal of labour bestowed upon it by two axemen, come down with a crash, and that was all the fun and profit got out of it, beyond the discomfiture of the bees, for the nest proved to be a duffer, and the bees were permitted to find new quarters.

The idea of these excursions was to get honey, and nothing but honey. Bees and brood-comb were discarded, the latter always; sometimes the former if they clustered in a come-at-able place, and it was near the house, were taken home and put in the typical gin-case hive, for the purpose of obtaining that better article, "garden honey," with a little less trouble.

Well, that day is fast passing away to be treasured up among the things that have been. The snap-shot illustrations in the August number are two or three stages towards fitting up an ideal bee farm. The operator has with him some modern bee appliances, notably that indispensable adjunct to bee-keeping, a smoke bellows. By-the-bye, it is an old-fashioned one and if he is not careful to stand it nozzle end up the fire will be choked with its own smoke. One of the newer pattern may be placed on the ground in the manner he has

it, but not the one he is using. I prefer the modern bellows of the Pender type (fig. 2).

Now, away in the bush many a good swarm of bees can be obtained in the way our hero with the smoker in his hand is doing. It is evident he is not gone out for honey and honey alone. Note his accompaniments. Nevertheless, by these he appears to be satisfied with two things—the *bees* and the honey. When you are chopping out a bees' nest you must go in for one thing more, the young brood in the comb. The bees are all very well as far as they go; they will do to unite with a weaker colony, or if they are numerically strong lay the foundation for a good colony. But the majority by far are mature bees, and their days are numbered. The life of the youngest of them at the outside will not be more than two months. The brood comb is the most valuable portion of the operator's find; therefore, it will be to you if you are going to do likewise.

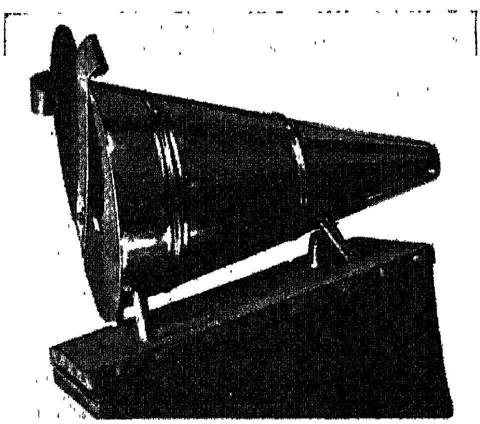


Fig. 1.—Clark.

You know the cook's old adage, "first catch your hare." When you have found your bees' nest, if the bees' entrance to the nest be within easy reach smoke the bees as the tree stands. Of course before you do that you will encase yourself as shown. There is no advantage to be obtained in giving them "a regular good dose of it." After three or four good whiffs of smoke have been driven in, rest awhile, and when the smoke has cleared away note the direction the bees are coming out from the entrance; that is, see if they are coming up from below or down from above. That little bit of observation will save you a deal of chopping. Do not fell the tree till you are sure the nest is out of your reach. If you fell the tree the chances are when it reaches the ground with a thud the comb will

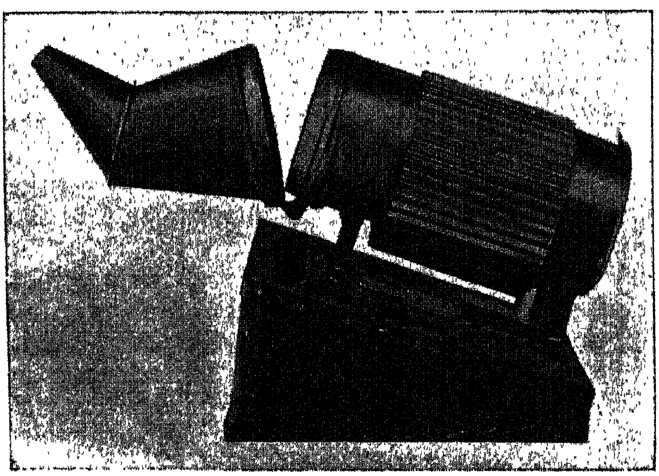


Fig. 2.—Pender type.

break into one conglomerate mass, and when you take out its contents it will be a perfect hotch-potch. By all means, if it be possible, chop the nest out as the tree stands. In chopping, when you come to the nest, with a little care, you will be able to secure the brood combs without breakage. Remember the young brood in the comb is the most important factor in the nest; that is if you are intending to strengthen your apiary. True, dirty and as full of foul matter as it may be, the honey is useful to feed back to your bees for winter storage. I have seen more than once, in chopping the bees from a log, when the nest is reached, that very few bees were to be seen in amongst it or on it. This is one of the most happy acts the bees can accomplish for their own safety and for your success in operating. The bees will leave from timidity as soon as they feel the jarring caused by the chopping process, act precisely the same as they do under the impulse of the tapping that is used in driving when transferring them from a gin-case hive to one of the modern bar-frame type, or as was done when robbing the former makeshift hives. The bees will only do so if there be an additional cavity in the tree by means of which they can escape from their two-footed enemy. In the illustration in August issue, our hero does not appear to have met with a tree with the desired additional cavity, or the bees are extra vigilant, judging from the swarming seen around both man and tub. In chopping do not spare the tree. Remove as much of the timber as will give you full access to the combs, so that they may be removed in as large slabs as possible. Large combs are always easier to adjust in bar-frames than smaller pieces. The latter always require a lot of manipulating to fit them. If, when you arrive at the nest, the bees are seen still clinging to the combs, try a little moral suasion to dislodge them therefrom. This can be accomplished by placing a box over the nest. See that one side of the box rests near to where the bees are in the most dense cluster so that they can ascend to it with freedom. Remove some of the combs gently. If there are no young brood therein, put it in the honey tub. All empty comb hold up to the light to see if there are eggs therein. They are as valuable as brood. As you take out each bit of comb examine it carefully to see if the queen is thereon. You are more likely to find her between the combs of brood, or where there are the greatest number of bees clustered. Satisfied that the queen is not on it, brush the bees off with a bunch of ferns or leaves, and put it in the receptacle for the honey; have another tub or box for the brood-comb. Do not mix the brood and honey together; it will cause the death of quite a number of bees. Having removed sufficient comb to get at the bees, commence to drive them into the box placed over to receive them. This cannot be accomplished with the gentle tapping given in the case of driving them from a box hive. Heavy thuds with the head of the axe will do it. Sometimes even this fails. In that case, disturb them by brushing them rather roughly with a bunch of ferns; at the same time drive in amongst them two or three clouds of smoke. They will very soon begin to travel into the box put to receive them. All the time you are preparing to drive

them, and whilst you are doing so, keep a constant watch for the queen. If she is seen moving into the box let her go, all the bees will soon follow. If she is seen moving away from the box, pick her up by the wing or the thorax—do not touch her abdomen, you may permanently ruin her laying powers—and put her in the box. Do not put her in the box unless there is a handful of bees clustered therein. There will now be no further trouble as regards securing the bees. In a little while you may remove the box a little further afield. In a few minutes the bees will be seen making towards it like a flock of sheep. Do not be in a hurry to go to work to get out the comb; it will soon be deserted by the bees. Of course there will be a few stragglers on each bit of comb as you remove it; these brush off near the box. As each bit of comb is removed it will be seen that most of what it contains is both brood and honey. Cut away the latter, dropping it into the tub with the honey. When the brood comb is much besmeared with honey you will find it more difficult to adjust in the frames. So far so good. Now let us see what comes after. You have the box containing the bees; a tub containing the brood; and a tub with the honey. If it be early in the day when you began work there may be a lot of bees still out foraging. In this case it is just as well to leave the box of bees where they are. Of course if it be too far from home you must put up with the loss of the few hundred bees that are away; otherwise you can leave the bees where they are till sundown. Take home the tub of brood and that of honey. I do not care what you do with the latter. Here it is none of my business to say anything about it. I want you to look after the bees and brood. At home you have, or ought to have, a bar-frame hive. If you are only going to transfer the bees to a box-hive, remember it is only one remove from where you took them. You know all about that method of doing things. I want you to become a bee master. There is a wide gap between getting honey out of a log, as you have been doing, and obtaining the comb honey from the one-pound sections taken out of a Langstroth super, or extracting it from the frames; and the gap is just as great in the article you obtain. You have the brood comb, but do not know how to fit it in the frame? Take a flat table, or some other flat surface; have a number of pieces of tape cut long enough to tie around a full-size frame, the narrow way; place three or four on the flat surface, parallel and equally distant, according to the size of the comb you are about to fix in the frame; place the frame on the tapes; cut the comb to fit a little tight in the frame, so that the bottom bar shall grip it firmly; it will be all the better to see that the comb is not put in upside down; adjust each frame in the hive. If not combs enough to fill the hive, put in a division board. Fetch your box of bees, and shake them out on the top of the frames; this is better than throwing them in front of the hive, for in this case they sometimes cluster under the hive, and it takes time to dislodge them therefrom. Cover them over with the quilt, and leave them till morning.

The details for all this, and the after management, are given in the 1898 December number. Follow fully what is there stated, and your efforts must be crowned with success.

The Export of Colonial Produce.

LECTURE BY MR. JAMES STEPHENSON.

The following is the report of a lecture delivered by Mr. James Stephenson, Secretary of the Board for Exports, under the auspices of the Hunter River Agricultural and Horticultural Association:—

The Chairman, in introducing Mr. Stephenson, said that gentleman would speak generally upon the production, shipping, and export of colonial produce in the Hunter and other districts. He might be permitted to point out that the production of wheat in New South Wales last year was nearly equal to the consumption, and this year there would probably be a further increase, so that the producers must look forward to the time when wheat would become an article for export, and its value would then be fixed at one place, Mark-lane, London. At present producers had to take what they could get for it, but when they began to export, it was not what they could get for it in Australia, but what was its value in the leading market of England. Wheat-production was also extending in Queensland. During a visit there a week before he had observed on the Darling Downs large patches of wheat which were becoming very close. There were fully 100,000 acres of land there fit for the cultivation of wheat which only wanted to be enclosed with a fence—land as good as any to be found in New South Wales or any other part of Australia. It was particularly rich land, and would grow lucerne, wheat, or maize, and was as largely favoured, perhaps, as land in the Hunter River Valley. In conversation with a number of Queensland gentlemen he was informed that the year was a record one for wheat, and cultivation was still increasing. That being the case, he thought they would have a very large export trade to deal with next year, and it was a matter which deserved the close attention and study of all who had the best interests of the colonies at heart.

Mr. Stephenson commenced by saying that if the farmers of the Hunter had anything to export he wanted to tell them the way to export it. It was true, as the Chairman had said, that the producers of the Colony had almost reached a stage when they could fully supply, not only its own requirements in wheat, but in other branches of production also. They had only raised enough wheat last year for home consumption, although, had the season been favourable, from 4,000,000 to 5,000,000 bushels would have been available for export, and it was anticipated that should we have a favourable season we would have even more than that available from next crop. That would be more than sufficient for home consumption, and the surplus must be exported.

The same obtained in regard to every other product; it would become imperatively necessary to export all kinds of colonial produce when once the supply became greater than local demand. Three and a half years ago the Government had appointed a Board for Exports to assist producers in the best methods of dealing with and finding markets for their produce, and how to prepare them for export. Timber, wines, wheat, grain, poultry, rabbits, hares, and all sorts of live stock and dead meat, and their shipping arrangements, were represented by the Board for Exports. That body met once a fortnight, and everything in connection with the packing, grading, freezing, &c., of exports was carried out under their direction. They were attending to the export of poultry, fruits, &c., and there was plenty of work for the Board to carry out in these lines alone for the next few years. One of the first things taken up by the Board was fruit. In the first year (1896) they called upon the fruitgrowers for reasonable-sized shipments to send to the Old Country, but their appeals were met with the utmost apathy—an apathy which he was sorry to say obtained to a very large extent still. The prices put on by the growers were prohibitive. They wanted twice as much from the Government for the purpose of trying the experiment as if they put them on the market themselves. The Board purchased a quantity of fruit, 15 per cent. of which had to be culled out before they were fairly fit for shipment. They had to procure new cases, and grade, pack, and ship the fruit. They got 14s. a case for the fruit in the London market, which would have left the producers a net return of 8s. per case, while they were selling the same fruit in the Sydney markets for 2s. 6d. The next year the fruit people did not ship, but last year they did. The operations were carried out by the fruitgrowers and shipping companies, but fully one-half the shipments arrived in London in a damaged condition. The result was a loss of between £5,000 and £6,000, which had to be shared between the growers and shippers. This failure and loss could have been obviated if the producers had sent to the Board for Exports for instructions, and had the shipping companies carried out the conditions. In December last the beekeepers of the Colony waited upon the Minister for Agriculture in reference to the export of honey. He told the deputation that if a certain quantity of honey of good quality were handed over to him he could within forty-eight hours get an offer of £15 per ton, f.o.b., as an advance on it in Sydney, or at the rate of 1¾d. per lb. The beekeepers represented that between 150 and 200 tons of honey were available for export, and promised to send samples to Sydney, but the returns up to the present, after eight months of hard work, had only been the offer of 28½ tons. The reasons for this had been variously explained, but the principal appeared to be that the charges made by the Board were prohibitive. The Board wished to allow the beekeepers to suggest for themselves what means were best to have the honey carried to London, but that it should be submitted to the Board to pass it; otherwise it would be useless to send it to the London market. If they sent Home 50 or 60 tons of honey containing as many different samples that would not do. The Board had offered to meet the beekeepers in every possible

way, and he (Mr. Stephenson) was deputed to lay before them the scheme he had mentioned as the only basis on which the export of honey could be successfully carried out, and yet the only response they had had from them so far was 28½ tons. What had been exported up to the present time would give the public and producers some idea of what the operations of the Board were. Two years ago they initiated the export of hares, rabbits, and poultry, carried out under their own direction. Stores were rented, costing them £550 per annum, and since then the stores had been extended and the rent increased to £1,200 per annum. The Victorians had previously made some experiments in this direction, and the first season good poultry was received, which brought good prices; but some brilliant genius bought up the whole of the old roosters he could get his hands on, cut off their spurs, and sent them to London as young birds; but that did not go down with the London buyers, and that experiment failed. There was no use in attempting to deal with that market except under certain conditions, because they never could compete with the continents of Europe and America, which were much nearer. But there were seasons at Home when poultry was scarce and brought good prices. For ten months in the year they could find a market for 10,000 head per week. The first shipment of ducklings sent Home by the Board were 9 weeks old, and they sold in London at 8s. per pair. The net returns, after paying all expenses, were 6s. per pair, or 3s. each, for 9 weeks old ducklings. The English market for these was practically unlimited. Such good prices, however, could not be expected every season. The Russian market for ducklings had been interfered with, and prices were in consequence very high; but if they only got 5s. 6d. per pair the expenses would not be more than 1s. 6d., and that would leave 4s. per pair net—a very good price for 9 weeks old ducklings. Poultry should not be more than 16 to 18 weeks old, and if of the proper kind would realise from 3s. 4d. to 3s. 6d. each, not per pair, so there was more money in poultry than one imagined. In the United States, in the year 1896, the consumption of poultry amounted to 290,000,000 dols. That was greater than all the pork industry of America, which did not reach more than two-thirds of this amount, and all this from the hen that lays the golden egg. The Hunter River district was very suitable for the breeding of poultry, and he commended its extension, saying that the English market for five months in the year was practically unlimited. Breeders must go in for a better breed of fowls. If they did that, even if the birds were not fit for the English market, they would get a better market for them locally. It was not a matter of breed so much as getting good crosses and having them bred of the proper size and feeding them well. Good crosses may be had from the Dorking, Orpington, Wyandotte, Game, or any of the large breeds of short and light legged fowls. Feeding was very important. It was no use attempting to get fowls up for export with the chicken flesh off, and it was necessary to remember that in England there was a particular demand for a particular article, and they were prepared to pay a particular price for it, and it was no use trying anything else.

He had been round the district that afternoon with Messrs. Rourke and Quinton and remarked on the extreme paucity of pigs. Pigs were one of the best paying animals under proper conditions that could be kept on the farm; but once farmers reached the limit of supplying their own markets they would have to make a difference in the system of breeding and feeding if they wanted a market for export. A great many people if they wanted a good ham for Christmas went to the shop and asked for an English ham. These so-called English hams were usually raised a few miles from Chicago. They were sent in a green state to Liverpool, where they were carefully dressed and smoked and made to represent some particular brand of English bacon, and then sent out to the colonies as the best English smoked hams, but the smoke was the only thing English about them. That was very similar to the hams made in the Colony. Good hams could only be obtained by feeding up on peas and beans, beans for preference. For the last few weeks of a pig's life milk should not be fed to it, nor maize, which was too heating and made the colour too high. He described the efforts of the Board in regard to the export of hares and rabbits. There were in Sydney at the present time no less than 180 tons of frozen hares waiting for export. During the last two years the Board had got rid of over 200,000 hares of an average weight of 7 lb. to 7½ lb. They must consider they were not only getting a good market for these, but that substantial sums of money were being brought to the Colony from this source. Up to the end of the present season from £22,000 to £23,000 had been coming into the country for the past two years from hares alone. There were nearly 400 men employed in the trapping, shipping, and packing of these. The total returns from hares and poultry exported for the past two years amounted to £29,600. That was actual cash that came into the country. The same could be done with other lines, but especially with poultry, and he advised the farmers to go in largely for these. The Board for Exports had always advocated that in the case of exports they should be submitted to expert examination before being allowed to go forth as the produce of New South Wales. Better to send a small quantity at first, the same as the Board did with fowls, than to send a large quantity of inferior stuff and spoil the name of New South Wales as a producing country. Frozen meat from the colonies had fluctuated in the English market because the good and the bad meat had been mixed up indiscriminately. And until they got a proper system of inspection it was no use to try to overtake the British market. What applied to beef applied to mutton. Until they had inspection and a rejection of inferior stuff by men with no selfish interests to serve, men paid by the country instead of the individual, New South Wales would never be able to take her proper place as an exporter of food for the British market. The question of cheaper freights was always strongly advocated by the Board for Exports. Exporters were paying ridiculous prices for some lines. For instance, mutton was carried at the rate of 40s., while hares and rabbits cost 70s. and fruit 85s. per measured ton—that was 2s. 3d. per cubic foot of space. That was more than double the price that dead

meat was carried for the graziers. The reason alleged by the shipping companies for this anomaly was that one was a small industry, and they must make a profit out of something. But he was pleased to be able to say that within the next two months they would have an additional fleet of steamers running regularly between England and New South Wales, and so he hoped with this advantage that next time he visited Maitland there would be much lower rates for freight, and that the export trade would be double what it was now. To find an export market they must begin at the beginning. It was no use producers saying this is the best we have, and this is the surplus we want to get rid of. The British market was not the market for the producers' surplus, but the market for the best they are capable of producing. Let them keep their surplus for themselves and their own markets, and export only their best. If they sent Home fowls half plucked, or with the skins torn, they would never be able to establish a profitable trade. The article should be prepared in the best possible way. Every man employed by the Board for Exports was an expert. They could take a fowl from a crate, and in 2 min. 45 secs. prepare it for the freezing chamber, and not a bit of torn skin would be seen. The best butter paper was used for wrapping the necks in, to prevent the body from being stained with the blood, sheets of the best white blotting-paper were used to place between the carcases, and the packing and all was done on behalf of the producer at a cost of 3d. each, the Board finding the cases. It was only by this means that it was possible for small producers to make anything out of it. That was the reason the Board had stepped in in the case of honey, which must be packed and sent away under proper auspices. Otherwise the producers would be incurring the risk of damaging the market. While the British market must for many years be their chief market—their largest consumers—they had Japan and China, the latter with its 400,000,000 of inhabitants, the Philippines, and South Africa, to which latter place they could ship 4,000 head of poultry by every boat. The whole secret of success was the raising of a proper article, prepared in a proper manner, and shipped in the best possible condition, and these markets and many others would be open to them. A shipment of honey sent from Victoria a few years ago had damaged the market for that commodity, because of some vile compound with an eucalyptus flavouring that had been put on the market at the same time as Australian honey by an enterprising Yankee. The facilities for export given to the producers of the Colony by the Board were not given for nothing. Some people thought someone was making a good thing out of this business, but the members of the Board gave their services gratuitously. They got a guinea for every sitting, which was about once a fortnight, but that did not pay men for the time they had to devote to it, exclusive of their own private affairs. He (Mr. Stephenson) was the only one paid a salary, besides two experts for dealing with poultry and rabbits, and when the work was done the wages ceased. The balance-sheet up to the 1st January last totalled, including £400 or £500 given to Agricultural Societies, and rent,

salaries, and wages, only £1,360. That represented the total cost to the country. There were special lines that the Hunter River district was suitable for producing. With its immense facilities, he was astonished at not seeing more stall-fed cattle raised. He did not know whether it paid the farmers of the district better to turn their crops into hay than to cultivate some root crops and buy store cattle for stall-feeding. If the latter were gone in for, he thought the farmers would find sufficient profit to pay them for their trouble. On a 60-acre farm in Scotland he had seen forty head of cattle with sheep kept, and the only return expected was the value of the manure, and these had to be stall-fed under cover for five months of the year. In this district housing was not required, and food could be procured from the lower pastures. Lucerne, he knew, was one of the best paying crops in the world, and one of the easiest to manage, but he thought a little more care might give the farmers better returns. That, however, was a matter for the farmers themselves. In regard to the breed of pigs, those raised in the district were not the best for export purposes. There were excellent samples of Berkshires, but consumers were now in favour of the large, leaner class of meat, and both British and American producers were crossing with the Tamworth breed, which they found gave better results. In poultry no particular breed could be called the best, but any farmer desirous of studying the matter could get the fullest possible details in the poultry pamphlets issued by the Board. If they allowed a pig to run about all his life they would have a very lean pig, but if they went in for raising fat pigs, as some districts did, on grain-stuff and pumpkins, they must depend on the local market. They would never get these fit for export. Pigs must have more of the nitrogenous, and less of the hydro-carbon, substances than maize would give them. To improve on this they would need to have a more judicious rotation of crops. For fattening purposes small patches of peas and beans and lentils were required, and a remarkably good and paying thing was broom corn. They could get a good price for the broom stuff after taking off the corn. He recommended the bending of the head of the stalk in cultivating millet, so as to let the weight carry down the heads. They would then have broom corn worth calling corn, and the stems and fibres would be longer and finer. Any lad could go over half an acre of land per day, and bend the heads of the corn in a proper manner. He had seen turnips in the district that day—he presumed a fair crop—which would yield from 4 to 6 tons per acre, but the rich land in the Hunter district was capable of producing 24 tons of turnips per acre if cultivated in a proper manner. The seed should be sown in drills. Turnips coming into Sydney from the northern rivers were chiefly fibre and water. Such a simple operation as drilling turnips and manuring the ground should be adopted, and the results would be surprising. With this method of cultivation 1¾ lb. of seed per acre would give better results than 5 lb. or 6 lb. of seed sown broadcast. Liquid manure could be put out in the field with an ordinary water-cart, filled with a pump from the manure pit, and the solid matter could be easily spread. All refuse matter should be

thrown into the manure pit. Drainage and subsoiling were also absolutely necessary on the farm. A little money judiciously expended in underground drainage would return fifty or one-hundred-fold the value of its cost. Improved machinery was also necessary, and with modern farming appliances not a single corner of the farm should be left untilled. These would only grow weeds if left to themselves, which would ultimately spread to other parts of the farm. Machinery, with proper subsoiling and draining, would make the Hunter district what he had often heard it called—the garden of Australia. The people had only to take advantage of the offers made by the Government for exporting. Everything, of course, had to be paid for. The soil of the district was perfectly capable of supporting a man on every 2 acres, and with a proper system of farming and manuring not only the Hunter, but all other farming districts in New South Wales, would flourish and blossom as the rose.

In reply to a question put by Mr. B. Long, Mr. Stephenson said that pits for storing green manure were generally made 4 feet deep with a bottom of puddled clay tapering a little towards one side. The green manure was put in and filled to the full height of the pit. All the liquid manure got down to one end, and this could be pumped out into a cask. Liquid manure was used principally on the pastures, the solid could be spread in the field.

In reply to questions, he said that London merchants were prepared to advance £15 per ton for honey, f.o.b., in Sydney, and for poultry an advance of 2s. per pair.

Mr. Worboys said the class of millet now grown was already too long for buyers, and the breaking of the heads would be no advantage if it made them longer.

Mr. Stephenson said perhaps the millet was too coarse. It was fineness and length that purchasers wanted.

Mr. B. Long proposed a vote of thanks to the lecturer. The lecture was one of the best they had had. It touched on matters all round, and they had not been kept too long. He did not altogether agree with all of Mr. Stephenson's remarks, especially with regard to the millet. That was an old-fashioned idea of some fifty years ago—breaking down the heads—and farmers who had thoroughly studied the question did not do it now, and he thought they were quite right. He was exceedingly pleased with the lecture, which was not only interesting but instructive. The question was one of the greatest importance, and he regretted there was not a larger attendance.

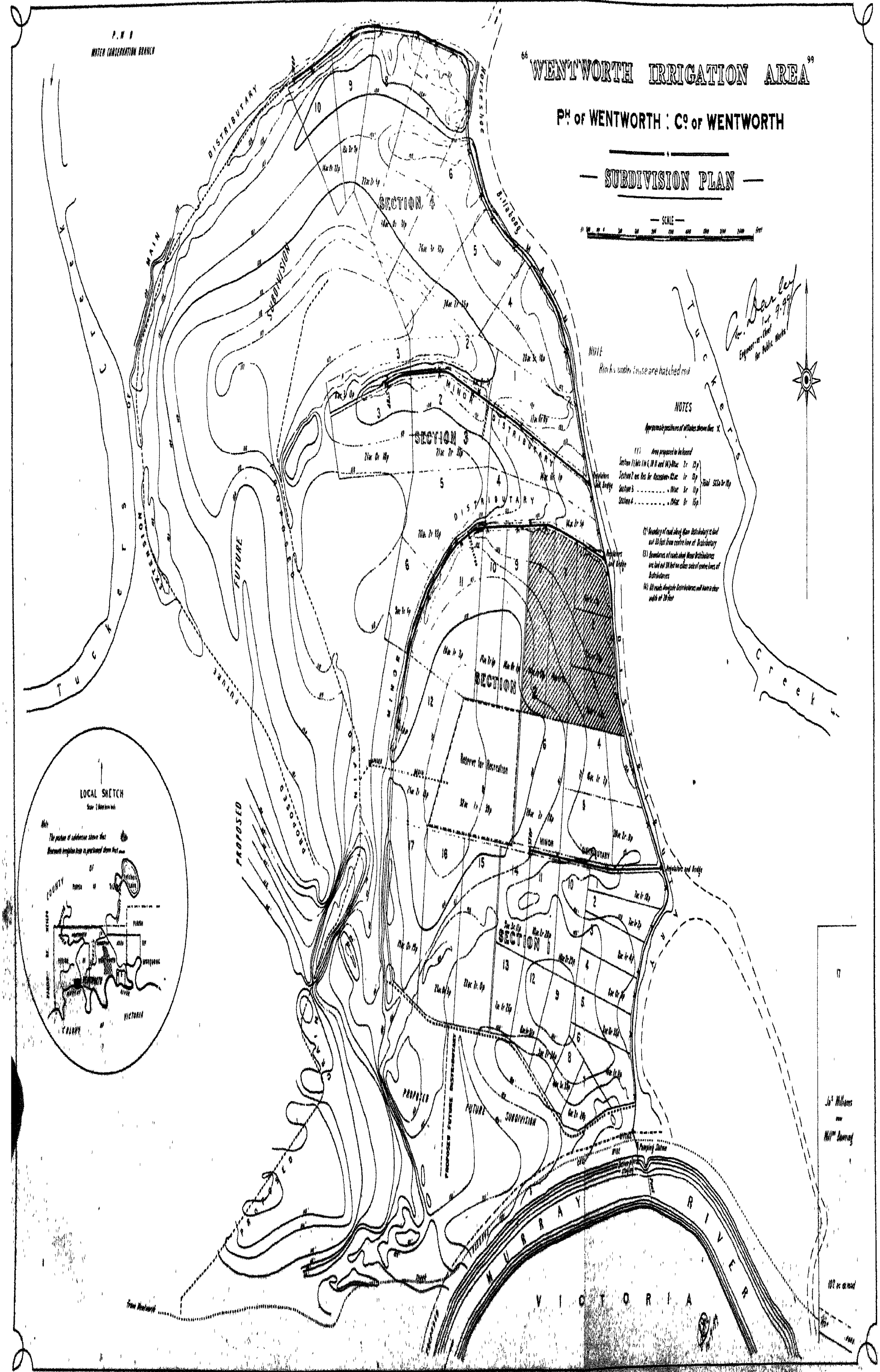
Mr. Robert Scobie seconded the resolution. He thought the lecturer represented a body that was doing a very good work for the Colony. They had commenced it, and would gain in the volume of business he hoped, and thus do a very good work for them as producers. The lecture had been given in such a way that he could not give it greater praise than to say it was a good, sound, common-sense lecture. A lot of information was given under the different heads

touched on. Some of the matters referred to—especially stock-feeding and other things in the district—a good deal could be said for and against. For instance, in stall-feeding cattle they would have to compete with the squatter, and about manures, in a particular way at Home they could produce a lot that was lost in this district through the want of housing, but they had the advantage here of not having to house much, which was a very great one indeed. The lecture, however, should be productive of good results to those who had heard it. He hoped, on some future occasion, they would have the pleasure of Mr. Stephenson's presence again. He was a gentleman who looked about him when travelling, and took notice of what he saw.

Mr. STEPHENSON considered no greater compliment could be paid to a lecturer than to ask him intelligent questions. With regard to Mr. Scobie's remarks about stall-fed cattle, he said don't compete with the squatter, but complete what he does. Get store cattle raised by the squatter and fatten them. He hoped that the export industry would expand to ten times its present volume, and it was doubling every year. It was in the producers' interest the Board was created, and if they were satisfied he hoped the results of their labours would continue to grow until they could find outside markets for every surplus that the Colony could raise, even though the population be a hundred times what it was at present.

Mr. LONG expressed a desire for the Poultry Expert to come and lecture.

Mr. STEPHENSON said the Poultry Expert was, fortunately perhaps for himself, not a lecturer, but he would endeavour to get him up. Mr. Bradshaw had prepared a pamphlet dealing with poultry, and as soon as that was ready he would send some for distribution to the Association.



P. W. D.
WATER CONSERVATION BRANCH
"WENTWORTH IRRIGATION AREA"
Ph. OF WENTWORTH : Co. OF WENTWORTH
SUBDIVISION PLAN
SCALE
NOTE
Blocks under lease are hatched red
NOTES
SECTION 4
SECTION 3
SECTION 2
SECTION 1
Reserve for Recreation
DISTRIBUTARY
MINOR DISTRIBUTARY
FUTURE SUBDIVISION
PROPOSED
Horseshoe Billabong
Tuckers Creek
MURRAY RIVER
VICTORIA
LOCAL SKETCH
Pumping Station
From Wentworth

touched on. Some of the matters referred to—especially stock-feeding and other things in the district—a good deal could be said for and against. For instance, in stall-feeding cattle they would have to compete with the squatter, and about manures, in a particular way at Home they could produce a lot that was lost in this district through the want of housing, but they had the advantage here of not having to house much, which was a very great one indeed. The lecture, however, should be productive of good results to those who had heard it. He hoped, on some future occasion, they would have the pleasure of Mr. Stephenson's presence again. He was a gentleman who looked about him when travelling, and took notice of what he saw.

Mr. Stephenson considered no greater compliment could be paid to a lecturer than to ask him intelligent questions. With regard to Mr. Scobie's remarks about stall-fed cattle, he said don't compete with the squatter, but complete what he does. Get store cattle raised by the squatter and fatten them. He hoped that the export industry would expand to ten times its present volume, and it was doubling every year. It was in the producers' interest the Board was created, and if they were satisfied he hoped the results of their labours would continue to grow until they could find outside markets for every surplus that the Colony could raise, even though the population be a hundred times what it was at present.

Mr. Long expressed a desire for the Poultry Expert to come and lecture.

Mr. Stephenson said the Poultry Expert was, fortunately perhaps for himself, not a lecturer, but he would endeavour to get him up. Mr. Bradshaw had prepared a pamphlet dealing with poultry, and as soon as that was ready he would send some for distribution to the Association.

The Wentworth Irrigation Area.

(From information supplied by the Department of Public Works.)

The Wentworth District.

Its Position, Land, Water, Climate, Productions, and Future Possibilities.—The Wentworth district, having Wentworth for its chief town, is situated in the south-west corner of New South Wales, at the junction of two of Australia's longest rivers, the Murray and Darling, and comprises, roughly speaking, an area that would be included in a circle of about 100 miles radius, taking the town of Wentworth as a centre. The river Murray, which depends for its main supply on the snow and rain falling on the Snowy Mountains and adjacent ranges, is navigable for steamers on an average for about eight months during the year, June to January inclusive, while the tropical rains falling on the Darling River catchment area in Queensland and Northern New South Wales during the early part of the year, provide a navigable river on the Darling and Lower Murray during part at least of the period when the Murray River would otherwise be too low for navigation. It will thus be seen that Wentworth is in the fortunate position of having water communication during the greater part of the year. In Appendix 1 is given a table of distances, etc., from Sydney, Melbourne, and Adelaide.

Land—Soil.—Of good land, rich soil, the Wentworth district has abundance. It is a desert in only one respect, that of rainfall. There are none of its broad plains but that if they were blessed with a uniform and timely rainfall during the spring, summer, and autumn would produce a hundred-fold. Water is the one great desideratum; that supplied, everything else follows. The higher lands, at an elevation of from 50 to 90 feet above the summer level of the rivers, are uniformly a rich, red, sandy loam, while the river flats are a rich alluvium fit for crops of all sorts.

Water Supply.—From what has been already said, the reader will infer that the water supply is ample for all the lands along and contiguous to the Murray River, which it is practicable to put water upon. This is really the case, and for eight months in the year there are in addition thousands of cubic feet per second running down to the ocean. Owing to the slight fall per mile of these rivers, it is impossible, except near their entrance into the plain country, to divert their waters by any gravitation scheme, and consequently all irrigation schemes along their lower parts must be pumping schemes, and limited in their extent.

Climate.—The reader is not going to be confronted with a tabulated statement of *maximum, minimum, and mean annual* temperatures, which when read appear like an abstract mathematical proposition. The climate is semi-tropic, that is, hot for four months in the year and delightful for eight. November, December, January and February

are the tropical months that give the country its abnormal productions. It is the heat and the water combined that work the wonders one sees in all such climates. When the word *hot* is used it should not be confounded with *sweltering*, like the days experienced along the eastern seaboard. The atmosphere is dry, and evaporation rapid, therefore the heat is not unbearable. The time when one hears complaints about the heat is after a shower, when the air is humid, the mercury falling to 85° or 90° in the shade. With the atmosphere in its normal desiccating condition, the mercury may rise over 100° in the shade, and one can go about his work with little or no inconvenience. The nights are generally cool, and one can get such a night's rest as makes good the day's waste, rising in the morning refreshed and ready for the day's duties and labours.

Having said this much in mitigation of the great bugbear that haunts the minds of strangers to this country, it is difficult to select words to give an adequate idea of the exhilarating stimulus of the remainder of the year. In the shortest days of winter the sun is bright and warm, and fires, except for household purposes, can be dispensed with, except morning and evening, when a fire is desirable to take off the slight chill in the air that is so perceptibly felt by old residents here. Frosts are never severe, the mercury never remaining below freezing-point for a sufficiently long time to do any serious damage. In the early spring the oranges, lemons, apricots, peaches, and grapes begin to put forth their bloom; in November figs and apricots ripen on the trees, and the beginning of December sees perfect bunches of grapes, covered with bloom and fragrance, hanging mellow and juicy on the vines, while with the least expenditure of energy, fresh vegetables may be served up with every meal every day in the year.

Productions.—All vegetables flourish, and it is only necessary to mention potatoes, sweet potatoes, onions, beans, peas, cabbages, cauliflowers, pumpkins, melons, tomatoes, besides unnumbered others, to show the possibilities in this line. All the cereals do well—wheat, oats, and barley bearing large crops in a favorable season, *i.e.*, one when sufficient moisture is available for them. With irrigation and the certainty of the required moisture large crops are rendered sure. Maize can be grown if planted early or late, sorghum, planter's friend, and all kinds of millet, &c., grow luxuriantly. Lucerne grows most luxuriantly, and will produce five or six cuttings annually.

But it is in the realm of the goddess Pomona where the infinite riches of this country will be found. The orange, the lemon, and the lime make fragrant with blossom and fruit all the days of the year, and such fruit! equalling the best that can be produced in the whole continent. The date will grow as rapidly and healthily as in Persia or Arabia, and should in time become an important tree both for its fruit and for ornamental purposes. The long-lived olive is at home here, and will add its contingent of oil and pickles to the wealth of the land. All the stone fruits grow with an abandonment of grace and beauty. Of the endless grape family that ripens here as early as in any place on the continent, and can be obtained till as late as June, it can be said that for productiveness, size, and flavour they cannot be excelled.

This list of productions might be extended indefinitely, for everything native to the semi-tropics might be added. This, however, is not necessary, for in those already mentioned, and which can be seen flourishing at Mildura and the various small gardens all along the river, are there not possibilities of luxury and wealth for those who settle in this virgin country?

The Wentworth Irrigation Scheme.—The Wentworth irrigation scheme had its inception shortly after the Chaffeys settled at Mildura, when the Wentworth Municipal Council, under a special Act of Parliament, endeavoured to launch the project, but failed for the want of funds. The Government then took it over, having in view the desirability of adding, if possible, another industry to the grazing and farming industries already in existence. It was felt that having such a magnificent and permanent water supply as exists in the river Murray, and the soil being uniformly suitable for irrigation, some effort should be made to establish an irrigation colony on the New South Wales side of the river. The Wentworth Irrigation Area comprises 10,000 acres of land situated in the eastern angle between the Darling and Murray Rivers. At present an area of 1,200 acres fronting the Murray, all within 4 miles of the town of Wentworth, is being dealt with, of which 600 acres is now open for selection on what is practically a perpetual leasehold basis. This area has been subdivided into blocks ranging in size from 7 to 34 acres, in such a manner that each block receives the water at the highest point and slopes to the natural drainage lines, thereby minimising the amount of grading required to prepare the land for irrigation.

Four and a half miles of channels with all necessary crossings, bulkheads, and outlets to each block have been constructed, a pumping plant capable of delivering 4,000 gallons per minute erected, and a supply of water equal to a rainfall of 30 inches per annum with a maximum of 4 inches per month will be allowed to settlers. This added to the average rainfall of 12 inches will give a supply equal to 42 inches per annum—a quantity ample for any production. The soil consists mostly of sandy loam, and the analyses made by the New South Wales Agricultural Department show that the soil is capable of producing all the crops before mentioned, for the report is thus summed up, "The soil is a very valuable one, both from its mechanical condition and its chemical constituents. With water judiciously applied it should bear good crops of anything, especially fruit of all sorts suitable to the climate, and when showing signs of falling off would easily be renovated by fair dressings of nitrogenous and phosphatic manures."

The adjacent cultivation on the Williamsville farm belonging to Mr. W. Bowring, also the gardens of Mr. W. J. Holding and many others in the vicinity of Wentworth confirm the above estimate of the capabilities of the soil under irrigation. Mr. J. L. Thompson, the New South Wales Government Travelling Agricultural Instructor, when visiting the area in 1891, said he had no hesitation in saying that the land would produce anything that might be grown in the southern hemisphere, and when revisiting the area in 1898 said he could only reaffirm his opinion as above expressed years previously.

Markets.—Situated as Wentworth is, a large amount of trade is done with settlers up the Darling River as far as Wilcannia, and there will always be a fair local market for such products as potatoes, onions, green and dried fruits, butter, bacon, etc., etc. As almost the whole of these articles consumed in the town of Wentworth and up the Darling River to Wilcannia is imported, there is no reason why the whole of the trade should not be gained by settlers on the Wentworth Irrigation Area.

The main markets will always be the intercolonial one which can easily be reached by water-carriage, or in the near future by rail to Melbourne, as the permanent survey of this line is now being made. The proposed terminus of the line is at Yetta, on the opposite side of the Murray River to Wentworth, whence goods can be landed in Melbourne within 24 hours. In view of the near approach of Federation, and the consequent abolition of intercolonial customs duties, this promises to be the principal outlet for the products of the Wentworth district, which, being one of the warm districts of the colony, has the advantage of an early ripening of its products, thus giving producers the benefit of the early markets when high prices rule. For citrus fruits there is always a good intercolonial market, more especially for lemons, while dried and pulped fruits are always in fair demand.

The Mildura Settlement in Victoria, about 15 miles higher up the Murray River than the Wentworth scheme, shows what may be done in the face of most adverse circumstances, and the financial collapse of the Company which had that settlement in hand should not deter settlers from taking advantage of the very favourable terms offered at Wentworth.

For the man in search of a suitable site for commencing operations, the Wentworth area possesses the following advantages:—

1st.—The scheme is under Government management, and so should not have the financial difficulties which the company running the Mildura settlement had.

2nd.—Water troubles should be unknown, as the whole settlement being compact, the seepage losses should be a minimum; the pumping plant is capable of supplying all the water necessary; the Regulations provide for an ample quantity for all requirements, and the agreement for such supply is absolutely binding.

3rd.—There is no large price to be paid for the land. Leases are granted for a period of thirty years, and on expiration are renewable for a similar period, fencing and cultivating being the only conditions imposed, thus giving settlers the privilege of putting their capital towards necessary working expenses.

4th.—The experience already gained from Mildura and elsewhere in the district should guard against the repetition of the errors made in planting unsuitable kinds of fruit, while the periodical visits of the experts of the Government Agricultural Department, who will advise settlers as required, should preclude any further blunders, other than wilful ones, in this way.

The following extracts from the Report of the Mildura Royal Commission (p. 16) bear out what has been said :—

Settlers' Returns.

Although the greater portion of the planted land cannot as yet be said to be in full bearing, a fair proportion of the fruit growers have been enabled to pay their way out of the produce of the soil, and, in some instances, to make a substantial profit during the past two or three years.

The following are a few instances of many who are in that position :—

Owner.	Area.	Returns.		Remarks.
		Gross.	Net.	
		£	£	
J. Hensilwood ...	40 acres	....	1894—251 1895—198	Land very much affected by salt and seepage.
J. T. Nevill ...	30 „	1894-5—309	149	
R. S. Hoops ...	20 „	1894-5—250	....	Lost at least 40 per cent. by placing fruit on market at wrong time.
T. Wilkinson ...	20 „	1895—750	330	3 tons of fruit not sold yet.
J. Maye	30 „	1894—400	220	
J. Reader ...	22 „	....	1895—120	
F. W. Judd ..	20 „	1895-6—373	205	
J. T. Lever ...	13 „	....	1896—140	
Captain Stokes ...	20 „	1896—223	146	
W. O. Mitting ...	10½ „	1896—430	362	
H. Hawthorn ...	71 „	1896—800	400	

It is, therefore, at once apparent that the collapse of Chaffey Bros. Limited Company does not necessarily imply the failure of Mildura.

The most successful holding is undoubtedly that of Lord Ranfurly, the area of which is about 243 acres. Mr. George Chaffey, in evidence, stated that, when in London, he was informed by Lord Ranfurly that, the year before last, his place paid him 5 per cent. This year, it is further stated, the return will probably be 15 per cent; but, judging by the evidence given by the manager of the estate, this only applies to the area in profitable bearing, which is less than one half of the entire block. It is to be noted, with regard to this holding, that no water difficulty is experienced, the channels being, as a rule, lined throughout, and the plant for raising the water being entirely separate from that of the settlement. It is to be reasonably inferred that had the other holdings been subject to similar conditions, no trouble such as that now affecting Mildura would have been occasioned.

The following paragraph, taken from *The Argus* of February 27, 1899, is of importance to intending settlers, as it applies to country of a somewhat similar character to that in the Wentworth district :—

Further proof that money can be made out of the use of the abundant supply of water for irrigation purposes in the territory of the Rodney Irrigation Trust has been furnished by an officer of the Agriculture Department. He states that on a recent visit to one of the butter factories in the Goulburn Valley he found that eighteen dairy farmers carrying on business within the area of the trust one-half were utilising the water for growing lucerne, and were obtaining splendid crops notwithstanding the dryness of the season. In some of the paddocks the lucerne was 18 inches high, and the cows fed upon it were in full profit, in spite of the extreme heat. These nine farmers were delivering between them 380 gallons of milk per day to the factory, and it was expected that the milking flow would be prolonged till May at least. The other nine suppliers who failed to take advantage of the irrigation delivered a total of only 104 gallons a day, and the supply was daily failing as the cows were rapidly drying off. The objection formerly raised against feeding dairy cows on lucerne, that it tainted the milk and also the butter produced from it, had been completely overcome by pasteurisation.

Experience teaches that a large area of land is not necessary, under irrigation, to give a good living to a settler with a family; but, at the same time, it also goes to prove that the thorough working of the land is as necessary as a good water supply. The following paragraph, from an able article on irrigation by an expert in the Chicago *Economist,* sums up the question of large or small holdings—

> A farmer who will scratch and grub all his life to get a mere living from a 160-acre farm will acquire a competency from 20 acres in a very few years where he has control of the water supply. He need not work half so hard and may enjoy some of the luxuries and comforts of life as he goes along. Or stated in another way, 160 acres of irrigated land will yield a competency for eight families enjoying the comforts of life, while one family depending on rainfall can barely get an existence from the same area.

The easy terms under which these blocks are leased, the quality of the soil, and the varied productions which can be successfully raised make this scheme one under which any man who intends to make a business of irrigation farming, can be certain of success. He can establish a comfortable home and have pleasant and at the same time profitable employment both for himself and his family. He will enjoy all the advantages of being in close touch with civilization and at the same time have a country life in the open air, while his family who will have all the facilities for obtaining a good education, as they grow up around him, can readily find openings in life on similar lines.

All details relating to the letting of the blocks, prices, &c., are published in the attached appendices, and any further information required can be obtained from the Water Conservation Branch, Public Works Department, Sydney, or from the Manager, Wentworth Irrigation Scheme, Wentworth, N.S.W.

APPENDIX 1.

Distances from Wentworth to—

	Coach.	River.	Rail.	Total miles
Sydney, *via* Hay	250	......	454	704
Melbourne, *via* Swan Hill	180	......	214	394
,, ,,	......	360	214	574
Melbourne, *via* Ultima (new line)	......	......	400	400
Adelaide, *via* Morgan	200	......	105	305
,, ,,	......	388	105	493

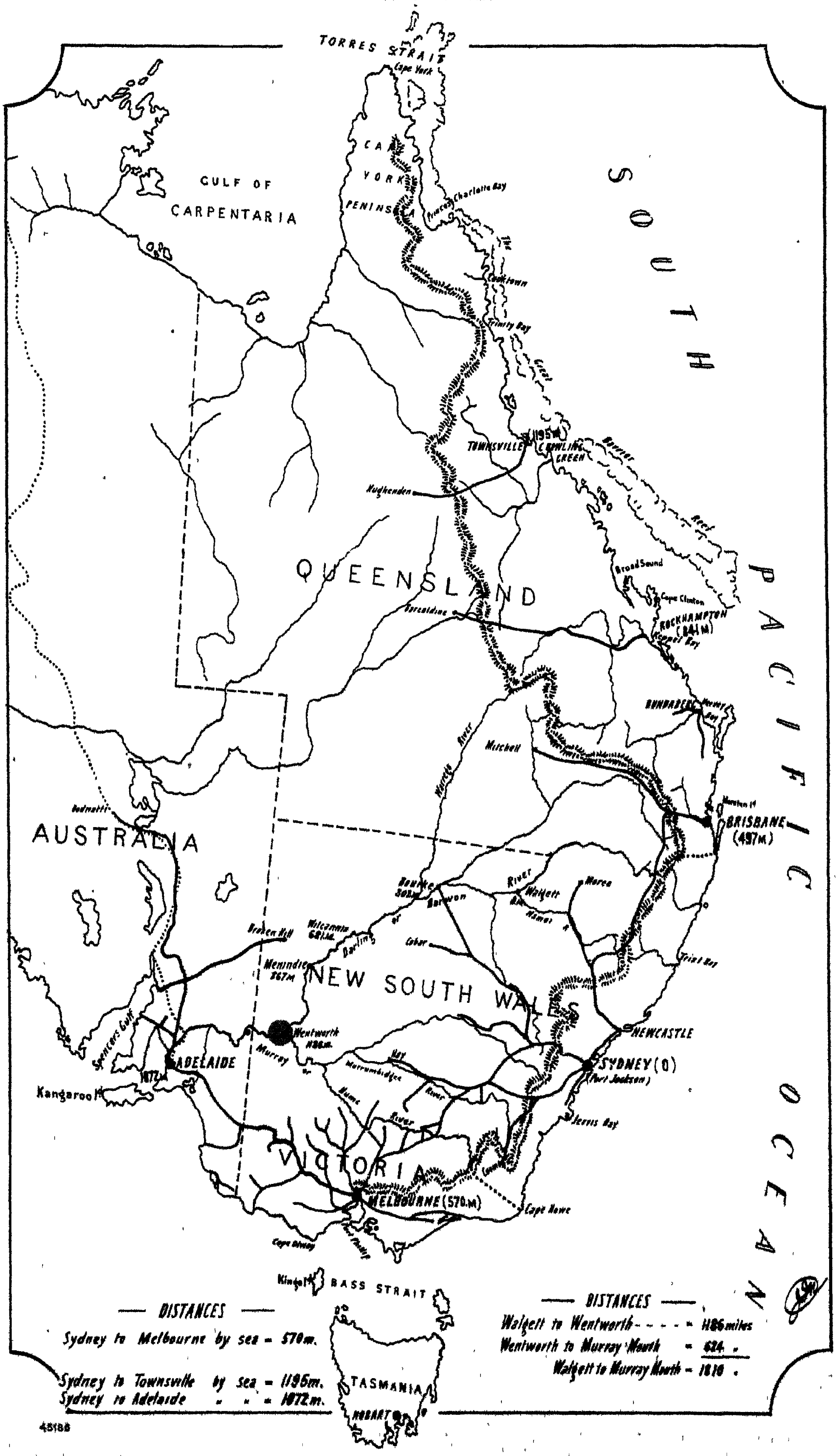
Passenger Fares from Wentworth to—

	Coach.		Rail.		Total.	
	Single.	Return	Single.	Return.	Single.	Return.
Sydney ...	£6	£10	70/- and 45/-	100/- and 65/-	9/10/- and 8/5/-	15/-/- and 13/5/-
Melbourne	£3	£5	38/5 ,, 25/7	57/10 ,, 38/5	4/18/5 ,, 4/5/7	7/17/10 ,, 4/18/5
Adelaide..	£3	£5	17/6 ,, 11/6	....	3/17/6 ,, 3/11/6	....

	Steamer.		
	Single.	Return.	
Melbourne	2/7/6	4/12/6	Then rail as above.
Adelaide..	£3 up. £2 down.	£5	Then rail as above.

Proposed fares by new line to Melbourne, *via* Ultima—

Mildura to Melbourne, 1st return, 4/12/6; second return, 3/1/10.



LOCALITY MAP, WENTWORTH IRRIGATION AREA.

Showing various Rail and Water Routes.

Freights per ton from Wentworth.

To Morgan, by steamer, 10/- ; Morgan to Adelaide, by rail, 25/- ; total, 35/-
To Swan Hill, by steamer, thence Swan Hill to Melbourne, by rail, 35/- to 40/-
Adelaide to Sydney, 10/- to 15/- per ton measurement.

Proposed freights from Mildura to Melbourne, (new railway).

(Parliamentary Standing Committee's report.)

Wheat	19/11 per ton.
Fresh fruit	33/11 „
Dried fruit / Fruit pulp / Canned fruit	46/2 „

APPENDIX 2.

REGULATIONS UNDER WENTWORTH IRRIGATION ACT.

Department of Public Works,
Sydney, 21st November, 1898.

His Excellency the Governor, with the advice of the Executive Council, has been pleased to make the following Regulations under the "Wentworth Irrigation Act," and hereby directs that the same shall be in force in respect of and apply to the Wentworth Irrigation Area.

J. H. YOUNG,
Minister for Public Works.

Regulations under the "Wentworth Irrigation Act."

Whereas by the "Wentworth Irrigation Act," the Governor, with the advice of the Executive Council, is, amongst other things, empowered to make Regulations for carrying such act into full effect, so as to provide for all proceedings and all other matters and things arising under, and consistent with such Act, and not expressly therein provided for:

Now, therefore, His Excellency the Governor, with the advice aforesaid, doth hereby, in exercise of the powers, conferred by the said Act, make the following Regulations, and doth hereby direct that such Regulations shall be in force in respect of and apply to the Wentworth Irrigation Area.

Interpretation.

1. In these Regulations, unless the context necessarily requires a different meaning, the expression—

"The Governor" means the Governor with the advice of the Executive Council.
"The Irrigation Area" means the Irrigation Area as defined in Section 4 of the "Wentworth Irrigation Act."
"The Minister" means the Minister for Public Works for the time being.
"Prescribed" means prescribed by these Regulations.
"Month" means calendar month.
"The Act" means "The Wentworth Irrigation Act."

Administration.

2. The administration of the Act shall be vested in the Minister for Public Works, subject to the provisions of the Act and these Regulations.

Manager.

3. The Irrigation Area shall be under the direction and control of the Manager, subject to the Act and these Regulations and the direction of the Minister.

Leasing of Lands.

4. The Governor may, subject to the provisions of the Act and these Regulations by advertisement in the Government Gazette and in a local newspaper, set apart from time to time the whole or any portion or portions of the land comprised within the Irrigation Area to be disposed of by lease as holdings under the provisions hereinafter contained. Such advertisement shall specify what lands are available for lease as holdings, and the area of such holdings, and shall state the rent and water rate, calculated at so much per acre, to be charged in respect of each of such holdings, and shall specify a date from and after which leases of such holdings may be applied for.

5. From and after the date so specified the Governor may, upon application being made as prescribed, grant leases of any lands so specified in accordance with such advertisement for any term not exceeding thirty years.

6. An applicant may in one and the same application apply for any one or more adjoining holdings.

7. Every application for a lease shall be made in accordance with the form No. 1 in Schedule A hereto, and shall contain all the particulars specified in such form, and shall be signed by the applicant.

8. Applications for lease must be lodged after the date specified in the advertisement provided for in Regulation 4 hereof, at the office of the Manager during office hours, on any day not being a Sunday or Public Holiday; and the hour and date of the receipt of every such application at such office shall be forthwith noted upon such application by the Manager or his representative, and signed by him. Every such application must be accompanied by the deposit provided for in Regulation 11 hereof.

9. In the event of the Minister deeming it advisable to alter or in any manner modify the area or boundaries of any holding or holdings applied for, he may by communication in writing, addressed to the applicant and posted to the address mentioned in the application, inform the applicant of the proposed alteration or modification, and if the applicant within twenty days after the posting of such communication inform the Minister in writing that he is willing to accept a lease of the holding or holdings as so altered or modified, then the Governor may grant the application as so altered or modified or may refuse the same. In the event of the applicant not agreeing to the alteration or modification within the time and in the manner as aforesaid, then the Governor may refuse the application.

10. Notwithstanding anything hereinbefore contained, the Governor may refuse any application, and shall not be compelled to give any reasons for such refusal, and may in any case where it appears to him advisable so to do, grant any application notwithstanding that any of the provisions of these Regulations may not have been complied with.

11. Every application for a lease must be accompanied by a deposit of ten shillings for every acre of land applied for in such application, such deposit shall be paid as provided in Regulation 12 hereof. And a receipt for such deposit shall be forthwith given to the applicant signed by the Manager or his representative, such receipt shall be in the form prescribed in Form 2 Schedule A hereto. Upon the execution of the lease and payment of the rent and water rate as provided by Regulation 19 hereof, such deposit shall be refunded to the applicant, and if any such application be refused or be withdrawn under the provisions of Regulation 15 hereof, such deposit shall be refunded to the applicant, and in any case where the application is altered or modified under the provisions of Regulation 9 hereof so as to reduce the area applied for the amount of deposit in excess of that required for such reduced area shall as herein provided be refunded to the applicant. Provided that where an application is granted and the applicant does not execute the lease within the time prescribed by Regulation 17 hereof such deposit shall be forfeited. No refund shall in any case be made except upon the demand of the applicant and the production and delivery by him of the receipt for such deposit upon which he shall endorse a receipt for such refund and the date thereof and sign the same.

12. Every such deposit may be paid either in lawful British money—Postal Note or Bank cheque. Provided that where such payment is by postal note or cheque no receipt shall be given for the same until such note or cheque has been paid by the Post Office or Bank upon which the same is drawn, and every application which is accompanied by a postal note or cheque shall be deemed to have been received on the day on which such note or cheque is made payable, in no case shall such application be deemed to have been received on a date earlier than that on which it actually reached the office of the Manager, and no such application shall be dealt with until such note or cheque has been paid as aforesaid.

13. Applications shall be deemed to have been made (subject to the last preceding regulation) at the hour and on the date on which they reach the office of the Manager. And in the event of any dispute as to the time of the making of any application the entry on such application of the hour and date of its receipt made as required by Regulation 8 hereof shall be conclusive as to the date of such application.

14. Where two or more applications for leases made at the same time are conflicting, the Manager shall, unless all but one be withdrawn, determine in the following manner how the applications shall stand to each other in the order of priority.

The Manager shall make a list of the names of the several applicants and shall number in consecutive order the names appearing on the list. The Manager shall select those of the marbles provided for the purpose which bear the same consecutive numbers as appear on the list, and shall place such marbles in the box provided for the purpose, and shall then lock such box and turn it round upon its axis as often as may be necessary,

and shall then draw out of such box all the marbles one by one. As the first marble comes out the Manager shall write the number 1 against the name of the applicant whose number on the list is the same as that on such marble; and as one by one the remaining marbles come out, the Manager shall in like manner write the numbers 2, 3, and so on against the name of the respective applicants. And the applicants shall stand to each other in order of priority according as the numbers relating to them come out as aforesaid. The Manager shall, after all the marbles have been so drawn, sign and certify the aforesaid list, and shall note and sign upon each of the applications the position which it bears in order of priority to the others.

15. At any time before the acceptance of an application by the Governor has been notified under Regulation 16 hereof, such application may be withdrawn by a communication in writing, signed by the applicant, and addressed to the Manager at his office. Provided that such withdrawal shall not be deemed to have been made until such communication is received at such office.

16. In every case the acceptance or refusal by the Governor of any application for a lease shall be forthwith published, together with the particulars of such application in the Government Gazette and in a local newspaper.

17. Within twenty days after the publication of the Governor's acceptance of any application for a lease, and upon payment of rent and water rate, as provided by Regulation 19 hereof, the applicant shall sign and execute a lease in the form prescribed by form 3 in Schedule A hereto; and if such lease shall not be so signed and executed by the applicant, and such rent and water rate so paid, the application shall, unless the Governor otherwise directs, be deemed to be abandoned, and no further steps, except the forfeiture of the deposit, shall be had thereon.

18. On the execution of the lease by the applicant as aforesaid, but not before, he shall be entitled to enter upon and take possession of the land, the subject of such lease, and to all the rights and privileges conferred by such lease, or by the Act and these Regulations, but no others. Provided that he shall not be entitled to cut down or remove any timber on the land, the subject of such lease, without first obtaining the written permission of the manager so to do.

19. On or before the execution of the lease, the applicant shall pay to the Manager the rent and water rate advertised as provided in Regulation 4 hereof, as chargeable on the holding or holdings applied for by the applicant, in respect of which his application has been accepted for the period intervening between the date of the execution of the lease and the 1st of January or the 1st of July then next ensuing, whichever shall be the sooner; and thereafter shall pay such rent and rate half-yearly, in advance, on or before the first day of January, and the first day of July in each and every year during the currency of the lease.

20. The rent and water rate made payable under any such lease, if not paid in advance, as provided by Regulation 19 hereof at the half-yearly periods therein named, may be recovered in a summary way before any two justices by any person appointed to collect and recover the same; and if such rent or rate, or either of them, be not paid within one month after same become respectively due or payable the Minister may re-enter and retake the lands in respect of which such rent or rate is so due and payable as aforesaid, and eject the lessee therefrom, and thereafter the Governor may, as herein provided, let the same to another tenant.

21. Within six months after the execution of any lease, the lessee must fence the whole of the land demised by such lease with a substantial cattle-proof fence, consisting of posts, two rails and one wire; or, posts, one top rail and three wires, or posts and five wires; and break up at least one-third of the area of such land for cultivation. Such fencing and breaking up of the land must be done to the satisfaction of the Manager.

22. A lease may be transferred at any time to any person approved by the Manager, but no such transfer shall be of any effect until the same is registered in the books of the Manager, and endorsed on the lease and signed by the transferror and transferee respectively. Provided that no such registration shall be made in the books of the Manager until all the rent and water rate then actually due and unpaid shall have been paid by the transferror. A transfer fee of twenty shillings shall be paid by the transferee before such registration.

23. A lessee may at any time, with the consent of the Minister, surrender his lease, and the Minister may accept such surrender, and the Governor may thereafter, as herein provided, let the land to another tenant.

24. At the expiration of the term of any lease, and on application being made by the lessee, the Governor may, if he thinks it expedient so to do, renew such lease for any further term, not exceeding thirty years, which he may deem advisable, and on such terms and conditions as he may require, and in like manner may grant a renewal of such renewed lease.

25. On the determination by effluxion of time of any lease or any renewed lease, and in the event of such lease not being renewed, the lessee shall be entitled to remove, if the Minister, in writing, so permits, all improvements made by him on the land, or if the Minister refuses such permission, then to receive compensation for such improvements. Provided that connections with the distributory channels, the fencing required by Regulation 21 hereof, the cultivation of the said land, or preparing the same for cultivation, shall not be considered as improvements. But where any lease or renewed lease shall be surrendered or entered upon under the provisions of Regulation 20 hereof the lessee shall not be entitled to any such compensation, or to remove any such improvements.

PART II.

Irrigation.

26. There shall be payable upon every lease by the lessee or his transferee a water rate at so much per acre on the land the subject of such lease; such rate shall be the amount as advertised under the provisions of Regulation 4 hereof, and such rate shall be payable as provided in Regulation 19 hereof.

27. Every lessee shall be entitled to receive a quantity of water equivalent to a depth of 30 inches per annum, but shall not be entitled to more than sufficient water to cover such holding to a depth of 4 inches at the most in any one month.

28. Every lessee will be supplied with water in rotation, and every lessee must make preparation to receive the water to be supplied to him by night or by day at such time as may be determined upon by the Manager and notified to the lessee in writing. In the event of any lessee not being prepared to receive the water at the time so determined and notified as aforesaid, his turn to receive such water shall be postponed, unless the Manager otherwise determines, until all the other lessees have received their supplies. And he shall then be entitled to receive his supply, so postponed as aforesaid, at such time as the Manager may notify him in writing.

29. Water in excess of the quantity specified in Regulation 29 hereof may, if the Manager think fit, be supplied to any lessee, and such water shall be paid for by the lessee at the rate of 1s. for every 4,000 cubic feet of water as measured or calculated by the Manager at the outlet from the distributory channel; such payment must be made to the Manager before such water shall be supplied.

30. When any lessee urgently requires his supply of water out of his order of rotation the Manager may, if he think fit, supply water to such lessee at such times as he thinks fit, and of which he shall notify the lessee in writing, and if such lessee is not ready to receive the water at such time then at such other time as the Manager may think fit.

31. The lessee shall, at his own expense, upon being required by the Manager so to do, make and thereafter keep in repair the connections between his holding and the outlet from the distributory channel necessary for conveying the water on to his holding. Provided that he shall give the Manager three days' notice in writing of his intention to make such connection, and he shall be bound to make such connection in such manner of such material and at such place as the Manager may direct, and shall not convey any water on to his land by any such connection until the same has been approved of by the Manager or his representative.

32. The water supplied to lessees for irrigation purposes shall be used solely for that purpose, and for no other, and no lessee shall have any right to waste the water so supplied.

33. The Manager or his representative may at any time enter upon the land of any lessee for the purpose of inspection, or regulating the water supply, and in the event of any water being taken or used in an unauthorised manner the Manager shall have power to stop all further supply of water to such lessee until the water so taken or used as aforesaid shall have been paid for by such lessee at the rate of ten pence per thousand gallons on the quantity estimated by the Manager to have been so taken or used. Provided that such estimate shall be conclusive against the lessee as to the quantity of water so taken or used. But this Regulation shall not be construed so as to relieve any such lessee from the penalties imposed by and recoverable under s. 49 of the Act.

34. The Minister shall not be liable for any failure to supply water to any lessee where such failure to supply water is due to the low state of the Murray River, or to any accident to the machinery or works, or to any cause existing on the land of the lessee.

Supply of Water for Purposes other than Irrigation.

35. The Manager shall be the agent of the Governor for the purpose of entering into agreements with the owners of land under the provisions of section 23 of the Act.

SCHEDULE "A."

FORM I.

Application for Irrigation Lease.

To The Hon. The Minister for Public Works, Sydney.

Sir,

I herewith make application in accordance with the Act, 54 Vic. No. 7, and the Regulations made thereunder, for a year's lease for the purpose of (Irrigation) of acres roods and perches, being lot of section within the Wentworth Irrigation Area, as advertised on the day of , 189 , and also for a supply of water for Irrigating the same, and I herewith lodge the sum of pounds shillings and pence, being at the rate of ten shillings per acre for every acre applied for.

Signature in full
Occupation
Age
Address
Date

Application received
From
Date
Signature of Manager or person receiving the application.

FORM II.

Receipt for Deposit accompanying an Application for an Irrigation Lease.

Wentworth, 189 .

No. 1

Received from of the sum of pounds shillings and pence (in cash, by cheque or postal note), being the deposit lodged by him with his application, dated the day of , 189 , for an Irrigation Lease for years of acres roods perches, being lot of section within the Wentworth Irrigation Area.

£ s. d.

Receiver of Public Moneys for Wentworth Irrigation Scheme.

FORM III.

Irrigation Lease.

VICTORIA, by the Grace of God, of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith, and so forth.

To all to whom these presents shall come,—

Greeting:

WHEREAS in conformity with the Wentworth Irrigation Act and the Regulations made thereunder, application has been made by , of , in Our Colony of New South Wales (hereinafter referred to as the Lessee, and which term, whenever hereinafter used, shall be deemed to include the said , his executors, administrators, and assigns), for an Irrigation Lease of the Lands hereinafter described, and for a supply of Water for irrigating the same, and the said application has been duly accepted by the Governor of Our said Colony, on the day of , 189 : Now, know ye, that in pursuance of the provisions of the said Act, and the Regulations made thereunder, We do hereby grant unto the Lessee, his executors, administrators, and assigns, a Lease of the lands within the Wentworth Irrigation Area, described in the Schedule hereunto written, together with all the rights, easements, and appurtenances to the same belonging, excepting and reserving unto Us, Our Heirs and Successors, all minerals as defined in the Mining Act of 1889, which may be therein or thereunder, together with full power and authority to Us, Our Heirs and Successors, and to any person duly authorised in that behalf by the Secretary for Mines and Agriculture for the time being of Our said Colony to enter upon the said land and search for, win, work, and remove all or any of the said minerals : And further reserving unto Us, Our Heirs and Successors, and to any person duly authorised in that behalf by

the Minister for Public Works of Our said Colony for the time being full power and authority to enter upon the lands hereby demised, and view and inspect the same: And further reserving unto Us, Ours Heirs and Successors, such powers of resuming the land hereby demised or any part or parts thereof as are contained in or provided by the said Wentworth Irrigation Act: To hold the said land unto the Lessee, his Executors, Administrators, and Assigns for the term of years from the date of the execution of these presents: Subject to the provisions, conditions, and covenants hereinafter contained, declared, or incorporated by reference herewith: Yielding and paying therefor during the said term the yearly rent and Water Rate of £ , being at the rate of per acre for rental of the land hereby demised, and per acre for Water Rate, such rent and Water Rate to be paid half-yearly in advance, the first payment being made on the execution of these presents, and such half-yearly instalments to be paid by the Lessee on or before the first day of January and the first day of July in each and every year during the said term: And it is hereby declared that all conditions and provisions, restrictions, and stipulations, either imposed by or contained in the said Wentworth Irrigation Act or any Act amending the same, or in any By-laws or Regulations made thereunder from time to time, although the same are not herein set forth, are embodied and incorporated with these presents as Conditions and Provisions of the Lease hereby expressed to be granted, and in particular that the Lessee shall and will duly pay in advance the Rent and Water Rate hereby reserved at the dates hereinbefore appointed for the payment thereof without deduction or abatement on any account whatsoever to the Colonial Treasurer of Our said Colony, or to the Manager of the Wentworth Irrigation Area, or to such other Officer as may from time to time be appointed to receive payment of the same: Provided always that if the said rent hereby reserved, or the said Water Rate hereinbefore mentioned shall be in arrear for one month after the same shall have become payable, whether such rent or Water Rate shall have been legally demanded or not, it shall be lawful for the Minister for Public Works of Our said Colony for the time-being, or any person authorised by him in that behalf, to enter upon the land hereby demised, or any part thereof, and seize and distrain all Machinery, apparatus, tools, wagons, carriages, engines, plant, and all other goods, chattels, and effects whatsoever in, upon, and about the said land and premises, and in every distress thus made may take away, sell, and dispose of as in cases of distress for rent reserved in common leases, and out of the moneys arising therefrom pay to the said Minister on Our behalf so much as shall be sufficient to satisfy the said arrears and interest thereon respectively at the rate of £5 for every hundred pounds per annum with half-yearly rests, and which respective rent, rates, or interest shall at the time of such sale be unpaid, and all expenses incurred by the said Minister in or in respect of such seizure, distraint, removal, and sale, and all moneys in any way due and owing hereunder, and if there be any surplus, the said Minister shall pay over the same to the Lessee, and the acceptance or receipt by Us, or on Our behalf, of any rent or water rate after the breach of any covenant herein contained or implied shall not be deemed to be a waiver of Our right to enforce this provision or the observance of any covenant herein contained or implied: And it is hereby declared that such of the provisions and conditions, restrictions, and stipulations herein declared and contained or incorporated herewith by reference as required or prescribed anything to be done or not to be done by the Lessee shall in addition to being read and construed as conditions of the Lease hereby expressed to be granted be also construed and read as covenants whereby the Lessee for himself, his heirs, executors, administrators, and assigns covenants to observe and perform the said provisions, conditions, restrictions, and stipulations: Provided always and these presents are upon this express condition that if and whenever the rent hereby reserved or the Water Rate made payable as aforesaid or any part thereof shall not be paid at the time hereinbefore appointed for the payment thereof or whenever there shall be a breach of any other condition or provision herein contained or incorporated herewith, it shall be lawful for the Governor of Our said Colony to declare by Notification in the Government Gazette that the Lease hereby expressed to be granted is forfeited unto Us, Our Heirs and Successors, whereupon these presents shall become of no effect and the said term hereby granted or any extension thereof shall absolutely cease and determine. In testimony whereof we have caused this Our Lease to be sealed with the Seal of Our said Colony.

Witness Our Right Trusty and Well-beloved Cousin HENRY ROBERT, VISCOUNT HAMPDEN, Our Governor, and Commander-in-Chief of Our Colony of New South Wales and its Dependencies, at Government House, Sydney, in New South Wales aforesaid, this day of , in the year of Our Reign, and in the year of our Lord one thousand eight hundred and ninety-

Signed, sealed, and delivered by the said in the presence of,—

APPENDIX 3.

[7191]

Department of Public Works,
Sydney, 1st February, 1899.

NOTIFICATION SETTING APART FOR LEASE CERTAIN LANDS WITHIN THE WENTWORTH IRRIGATION AREA.

His Excellency the Governor, with the advice of the Executive Council, directs it to be notified that, in pursuance of Regulation 4 of the Regulations made under the "Wentworth Irrigation Act," the lands comprised within the Wentworth Irrigation Area, as specified hereunder, shall be set apart to be disposed of by lease as holdings under the provisions contained in the said Regulations, and that applications for Irrigation Leases on the prescribed form will be received from and after the 20th instant.

J. H. YOUNG,
Minister for Public Works.

WENTWORTH IRRIGATION AREA.—LANDS AVAILABLE FOR LEASE AS HOLDINGS.

First Subdivision.

SECTION 1.

Block.		Annual Payments to be made.		
No.	Area.	Rent, calculated at per Acre.	Water rate, calculated at per Acre.	Total Payment.
	a. r. p.	£ s. d.	£ s. d.	£ s. d.
1	7 1 18	1 10 0	7 10 0	9 0 0
2	7 1 2	1 9 0	7 5 0	8 14 0
3	8 1 4	1 9 0	8 5 0	9 14 0
4	8 0 9	1 4 0	8 0 0	9 4 0
5	8 0 35	1 9 0	8 5 0	9 14 0
6	10 1 11	2 1 0	10 5 0	12 6 0
10	10 2 29	1 12 0	10 15 0	12 7 0
11	10 2 20	1 12 0	10 15 0	12 7 0
14	9 3 11	1 14 0	9 15 0	11 9 0

SECTION 2.

Block.		Annual Payments to be made.		
No.	Area.	Rent, calculated at per Acre.	Water rate, calculated at per Acre.	Total Payment.
	a. r. p.	£ s. d.	£ s. d.	£ s. d.
1	6 3 19	1 14 0	6 15 0	8 9 0
2	8 1 39	2 2 6	8 10 0	10 12 6
3	10 1 30	2 7 0	10 10 0	12 17 0
4	16 1 2	3 5 0	16 5 0	19 10 0
5	20 2 0	4 2 0	20 10 0	24 12 0
6	22 2 28	1 1 0	20 15 0	21 16 0
7	14 1 0	2 10 0	14 5 0	16 15 0
8	14 1 37	2 3 6	14 10 0	16 13 6
9	14 0 1	1 15 0	14 0 0	15 15 0
10	13 2 1	1 14 0	13 10 0	15 4 0
11	24 1 3	3 13 0	24 5 0	27 18 0
12	25 2 13	1 18 6	25 10 0	27 8 6

SECTION 3.

Block.		Annual Payments to be made.		
No.	Area.	Rent, calculated at per Acre.	Water Rate, calculated at per Acre.	Total Payment.
	a. r. p.	£ s. d.	£ s. d.	£ s. d.
1	14 0 1	3 3 0	14 0 0	17 3 0
2	21 2 37	3 5 0	21 15 0	25 0 0
3	21 0 10	3 3 0	21 0 0	24 3 0
4	14 2 5	3 5 0	14 10 0	17 15 0
5	20 2 33	2 12 0	20 15 0	23 7 0
6	9 3 5	0 14 6	9 15 0	10 9 6

SECTION 4.

Block.		Annual Payments to be made.		
No.	Area.	Rent, calculated at per Acre.	Water Rate, calculated at per Acre.	Total Payment.
	a. r. p.	£ s. d.	£ s. d.	£ s. d.
1	17 0 0	2 19 6	17 0 0	19 19 6
2	11 0 3	1 13 0	11 0 0	12 13 0
3	8 3 0	1 2 0	8 15 0	9 17 0
4	20 3 38	4 14 6	21 0 0	25 14 6
5	24 2 35	4 6 6	24 15 0	29 1 6
6	26 3 32	4 1 0	27 0 0	31 1 0
7	34 0 31	2 11 6	34 5 0	36 16 6
8	22 2 5	2 5 0	22 10 0	24 15 0
9	13 3 9	1 7 6	13 15 0	15 2 6
10	14 0 22	1 15 6	14 5 0	16 0 6

[7192]

Department of Public Works,
Sydney, 1st February, 1890.

LEASING OF LANDS WITHIN THE WENTWORTH IRRIGATION AREA.

WITH reference to the notification of the Governor-in-Council respecting the setting apart for lease of certain lands within the Wentworth Irrigation Area, it is hereby notified that applications for Irrigation Leases, on the prescribed form, will be received from and after the 20th instant, at the Office of the Engineer and Manager, Wentworth Irrigation Works, Wentworth.

The prescribed form of application and further information may be obtained at the Office of the Principal Assistant Engineer, Water Conservation Branch, Department of Public Works, Sydney; and of the Engineer and Manager, Wentworth Irrigation Works, Wentworth.

The lessee will be required to pay the stamp duty chargeable by law, namely, 2s. 6d. on the lease and 2s. 6d. on the counter-part lease.

J. H. YOUNG,
Minister for Public Works.

APPENDIX 4.

(Plates.)

AN outline map of the Wentworth Irrigation Area subdivision, showing blocks, areas, and position of channels; also, small locality map, showing position of Wentworth relatively to Sydney, Melbourne, and Adelaide.

Dairy Bacteriology.

(Continued from page 895.)

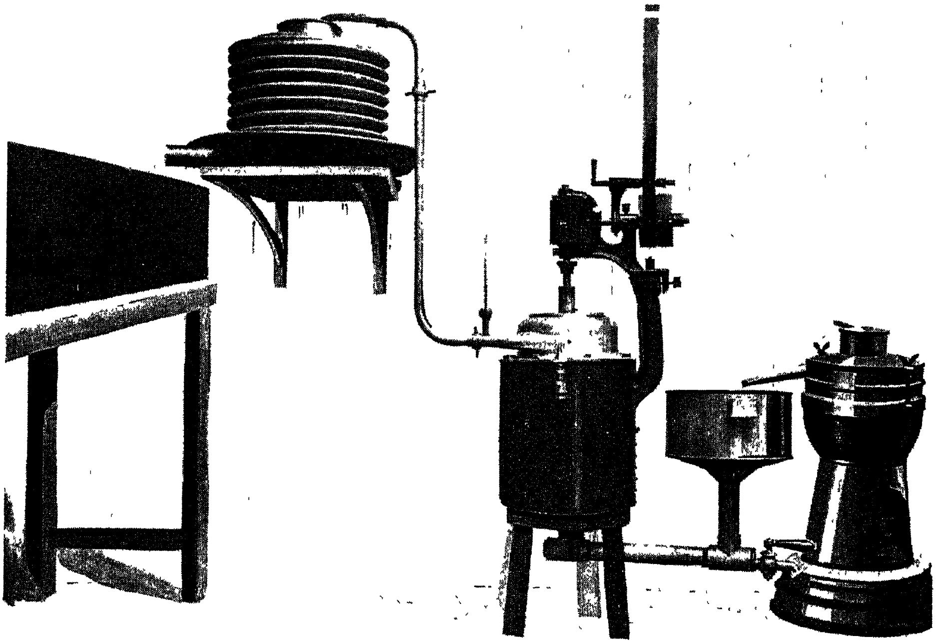
M. A. O'CALLAGHAN.

Pasteurisation and Sterilisation.

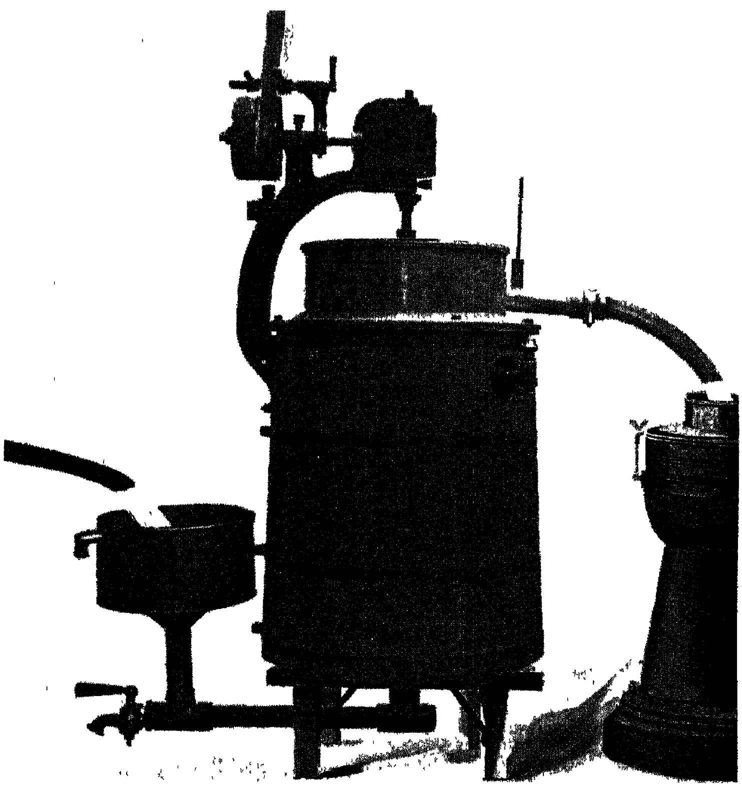
THE next point that concerns the operator, as regards pasteurising, is the temperature which he shall employ. It has been pointed out that the destruction of micro-organisms depends, not only on the temperature, but on the length of time at which the liquid that has been pasteurised is retained at a temperature above the thermal or dead-point of the organisms that it is intended to destroy; hence, in ordinary pasteurising, as practised in dairy factories, the completeness of the work will depend on the amount of milk or cream which is allowed to pass through the machine per hour, as well, of course, as on the capacity of the machine. If a factory purchases a 200-gallon-per-hour pasteurising plant, and tries to run 300 gallons per hour through the machine, this would only be playing with the work; and, while the cream may be called the pasteurised article, it is not so in the proper sense of the word, as understood by the workers in dairying, simply because it is beyond the capacity of the machine to heat such a large quantity, together with the fact that each particle of milk will remain in the machine a shorter time than if a smaller stream of milk were passing through. The temperatures which are advisable for us to employ must depend on the article we are treating and the object we have in view. If we are pasteurising milk solely from a butter-maker's point of view, and not taking into consideration at all the question of ridding the milk entirely of any pathogenic (disease-producing) organisms that it may contain, such as tubercle bacilli, then we need not use nearly so high a temperature as would be necessary in case we required to make the milk an absolutely safe food for drinking purposes for man and stock. Also, if cream is to be pasteurised instead of milk, the temperature employed need not be so high, as then we are simply aiming at the wants of the butter-maker alone, together with the fact that if cream is as thick as it is often separated in this country, viz., containing about 50 per cent. of butter-fat, it will be inadvisable to carry it to an unnecessarily high temperature, as then the result would probably be a greasy butter; in fact, cream containing 50 per cent. of butter-fat is too thick for perfect pasteurisation from a butter-maker's point of view, and cream which has to be pasteurised had better contain only from 30 to 36 per cent. of butter-fat. The temperature necessary to employ, then, would not be more than about 160 degrees Fahrenheit, provided the cream has not been held too long, which delay would mean a big development of micro-organisms, all of which would require to be put at rest, and, consequently, necessitate a

higher temperature. In Scandinavia—the country where pasteurisation first became used by dairy-workers—the cream, not the whole milk, is generally pasteurised, this being done immediately the cream issues from the separator, the cooling being performed directly the cream leaves the pasteuriser, the "starter" being then added without delay also. The separated milk is then pasteurised separately before being returned to the farmers, the temperature employed being 185 degrees Fahrenheit. It might be mentioned that this latter is compulsory according to the Danish law, and has been put in force with a view to preventing the spread of tuberculosis in young stock. In this Colony it will be found, owing to the high temperature of the atmosphere and the rapidity with which fermentation sets in, more efficacious to pasteurise the whole milk at the separating stations. The temperature usually employed for this is about 170 degrees Fahrenheit; and, according to the most recent investigations, this temperature is sufficiently high to destroy tubercle bacilli, provided the milk is kept at this temperature for a few minutes, or at 155 degrees Fahrenheit for twenty minutes, and this should be a matter of easy arrangement in our factories. It would be only the matter of an additional separated milk-tank and some other slight contrivance, which would enable the milk to remain in an intermediate tank for about twenty minutes before running into the tank from which the former supplies are drawn. Owing to the bearings of some separators becoming very hot when a higher temperature than 170 degrees is used, it would not be found easy to use a higher temperature with whole milk, but should the factory or farmer be unable to construct a means by which milk can be kept above 150 degrees Fahrenheit for about twenty minutes, then there is no reason save that of a slight expense why the separated milk should not be passed over a second heater as it leaves the separator and raised to a very high temperature, say, 195 or even 200 degrees Fahrenheit. It would require very little heating power to bring the milk up from, say, 165 or 170 degrees to 195 degrees, and the cost would be a very small item indeed when compared with the loss which annually takes place in our stock from tubercular disease. I give herewith illustrations showing a cream pasteuriser (*a*) at work; also a milk pasteuriser (*b*). It is seen in the former that the cream enters the pasteuriser as it leaves the separator, where it is heated to the required temperature and then elevated over a circular cooler inside which cold water is passing, the cream passing from the cooler into a cream reservoir or ripening tank. In the second illustration (*b*), the milk is seen issuing into the receiver of the pasteurising plant, from which it issues into the separator. These are photographs of pasteurising plants imported by the Department of Agriculture, and which are offered for prizes at some of our shows. The milk-pasteurising plant is capable of treating 400 gallons per hour in a cold climate where milk arrives much cooler than in this Colony, and the cream pasteuriser is capable of treating 100 gallons per hour.

I have in previous articles given illustrations of the bacteriological conditions of pasteurised and non-pasteurised milk, where it was seen clearly that when pasteurisation was properly carried out, few, if any,



(*a*) Cream Pasteurising Plant.



(*b*) Milk Pasteurising Plant.

organisms had sufficient life left to grow after the work had been done. I now give photographs I have made of bacteriological plates representing the comparative conditions of properly-pasteurised and non-pasteurised butters, or rather butters made from pasteurised and non-pasteurised cream. The pasteurised butters were not specially made for the purpose of illustration, some of them being purchased in a Sydney shop, and the non-pasteurised butters, whose condition is also illustrated, were also purchased in Sydney grocers' shops. In the pasteurised butters no organisms are seen save varieties of lactic acid organisms, which were introduced into the cream for purposes of ripening, and which might almost be said to be natural to milk and butter. The colonies of organisms seen in the other three illustrations are of various kinds, some liquefying and some non-liquefying, and some which I would not willingly introduce into my system.

While on this subject of pasteurisation and sterilisation, I would like to draw attention to the very notable and consistent results recently obtained by C. E. Marshall, Ph.B., Bacteriologist to the Michigan State Agricultural College, when experimenting on the question of destroying tubercle bacilli by the process of pasteurising. The milk was infected with tuberculous matter obtained from cows. Portion of the milk (1 cc) was then inoculated intra-abdominally into guinea-pigs. The remainder of the milk was then pasteurised at a temperature of 155 F., the milk being retained at this temperature for twenty minutes. Portion of this milk (5 cc.) equal to five times the amount injected into the guinea-pigs receiving the unpasteurised dose, was then injected into several other guinea-pigs, and the various animals watched from day to day. All the animals injected with the non-pasteurised infected milk died within a few weeks later, and the after-examination in all cases revealed the presence of tuberculosis in an advanced stage, while none of the animals that were inoculated with the pasteurised infected milk ever showed the slightest trace of the disease either while living or on examination after being killed. To make the experiments more valuable the tuberculosis material used to infect the milk was obtained from five different sources, and five different experiments were conducted, and in all cases the result was the same as above chronicled. A similar set of experiments was carried out with infected milk pasteurised at higher temperatures. The milk was brought to boiling-point and held there for five minutes, then cooled and inoculated into guinea-pigs. The results were identical with those when the lower temperature was used to pasteurise, and the heat sustained for a longer time, namely, all the animals inoculated before the milk was pasteurised contracted tuberculosis, while none of those inoculated with the pasteurised article contracted the disease.

THE following notes show how injurious these micro-organisms are to the keeping quality of cream and butter:—

Bacillus subtilis.—When milk is inoculated with this organism it is coagulated and afterwards rapidly peptonised. The fluid becomes of a dirty brown colour, and possesses an extremely bitter taste. This bacillus commonly occurs in water, dust, fæces, hay, &c. It forms spo es, which are very resistant to heat.

Bacillus butyricus (Hueppe).—This organism, when found in any quantity in butter, is an almost certain sign of uncleanliness in the dairy. When cultivated in milk a coagulation occurs similar to that produced by rennet without the reaction of the milk being changed. The casein is next dissolved, being changed into peptone and other products. A bitter taste and strong cheesy odour are produced.

Both these bacilli have an energetic action on the casein which remains in the butter, and are often found together in rank, inferior butters. Butyric acid bacilli, of which several species are known to bacteriologists, are the usual cause of cheesy butter.

Bacterium Coli commune.—This bacterium, also known as the colon, or fæces bacillus, is a normal inhabitant of the intestinal tract of men and various animals. This organism finds its way into milk either from polluted water, or what is more often the case, from particles of dung, which are adhering to the body and udder of the cow, falling into the milk pail during the operation of milking. In milk, it causes coagulation with acid reaction. From this fact it might be inferred that it would be of a harmless or even useful nature to the butter-maker, but the reason that it is a very undesirable bacillus to find in butter is that it possesses pathogenic or disease-producing properties. It is found associated with such diseased conditions as suppurating processes in the peritoneal cavity, affections of the liver, infectious enteritis, &c. Though this bacillus is not found with the typhoid bacillus in typhoid lesions yet it is the opinion of many that it frequently produces a secondary infection. In a large number of cases of English cholera, or "cholera nostras," examined by Dr. Klein, under the auspices of the Local Government Board (Local Government Board Report, 1895–6), the *Bacillus Coli communis* and another organism named *Proteus vulgaris* were found to be profusely abundant in the dejecta of patients. The *B. Coli communis* chiefly predominated, and sometimes appeared in almost pure growth.

From the previous paragraph it will be seen that it is not desirable to eat butter containing bacilli of such a dangerous character, even though they are normal inhabitants of the intestines, for if they increase through any cause in very large quantities, then they are liable to exert their pathogenic properties. When it is borne in mind that this bacillus is destroyed when exposed to a temperature of 66 degrees C. (150·8 Fah.) for five minutes, it will be seen that the process of pasteurisation will effectively destroy this organism when present in milk or cream.

Though pasteurisation as applied to cream will destroy all non-sporogenic bacteria present, yet it will not destroy the spores or seeds of such organism as the previously mentioned *Bacillus subtilis* and *B. butyricus*; hence the necessity for cleanliness at the milking bails, and during the subsequent handling of the milk prior to separation and pasteurisation. Fig. 20 shows the bacteriological condition of a cream which was pasteurised and allowed to stand twenty minutes before "lactic ferment" was added. Though it might be argued that the organism shown in the plate culture (an almost pure plate of *B. subtilis*) fell in during the period it was allowed to stand, yet they could not have increased in such enormous numbers as are here represented, especially as the presence of large numbers of bacilli of the lactic acid forming group have a deleterious effect on the growth of such bacteria.

The necessity for great cleanliness in dairies, butter factories, and all in connection therewith will be seen on examining Fig. 21, which is a photograph of a gelatine plate exposed to the atmosphere of a camping residence in which factory employees dwelt. The same varieties of organisms were also found in the air of the factory.

During the short time which this plate was exposed, no less than 56 living micro-organisms full upon this small surface. Of these 32 were moulds, being of three different species, all of which are injurious to the keeping qualities of butter. (These are the round white colonies dotted about the plate.) A liquefying colony of *Bacillus subtilis* is seen at the lower right hand side of the photograph, and a large colony of *Bacillus butyricus* near the centre. The remaining colonies are composed of various micro-organisms, tourlae and various species of micrococci and bacilli, which are harmless, and produce no change in cream or butter.

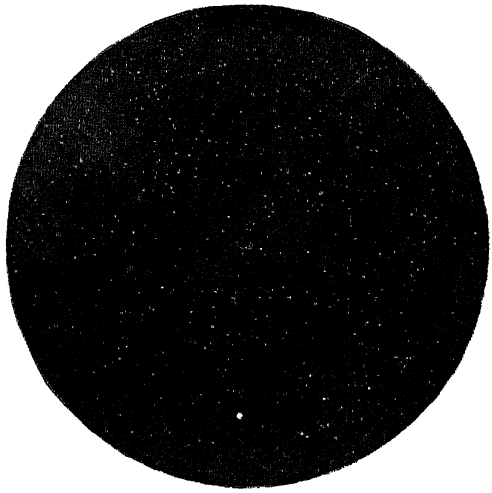


Fig. 14.

Description of illustrations showing colonies of micro-organisms found in pasteurised and non-pasteurised inferior butter. Plates 14, 15, and 16 only show micro-organisms of the lactic acid (milk-souring) variety. Plates 17, 18, and 19 represent the bacteriological condition of unpasteurised butters as purchased in some Sydney stores.

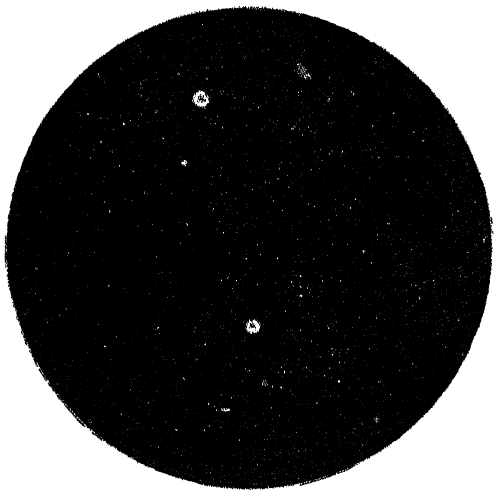


Fig. 15.

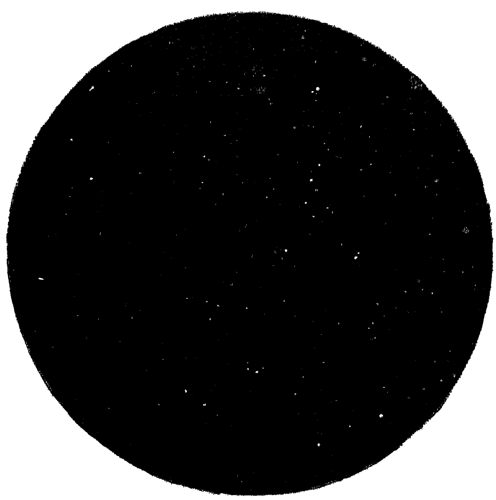


Fig. 16.

DAIRY BACTERIOLOGY.

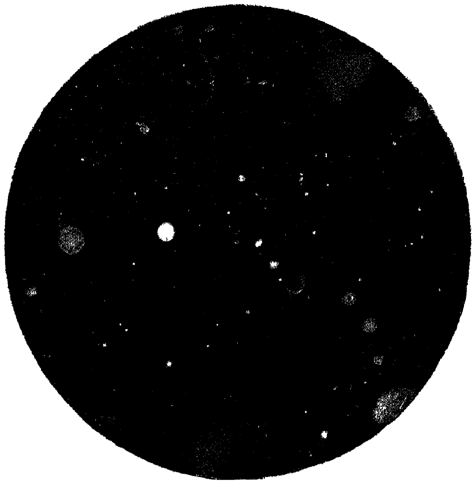


Fig. 17.

No. 17 contains three varieties of organisms of an injurious nature from a butter-maker's, and hence also from a consumer's, point of view, viz. — B. Subtilus (two colonies), B. Butyricus (one colony), B. Coli Commune (several colonies). No. 18 contains colonies of these three organisms also, but in different numbers, there being a large number of B. Butyricus present. No 19 contains a preponderance of B. Coli Commune (the medium white colonies with irregular edges), two colonies of the mould Oïdium Lactis, and some young colonies of Micro-Flavus Liquefaciens—all injurious; and several colonies of useful B. A. Lactici, and one colony (neutral) of B. Figurans.

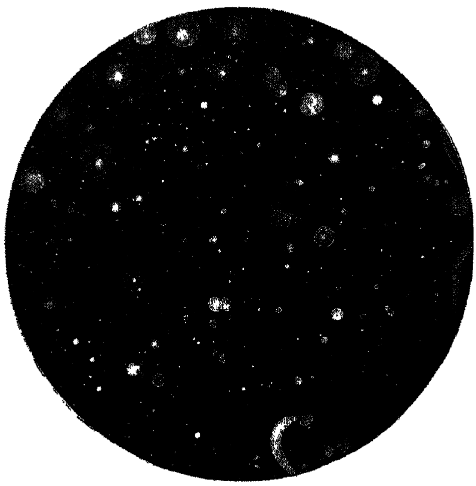


Fig. 18.

Fig 19.

DAIRY BACTERIOLOGY.

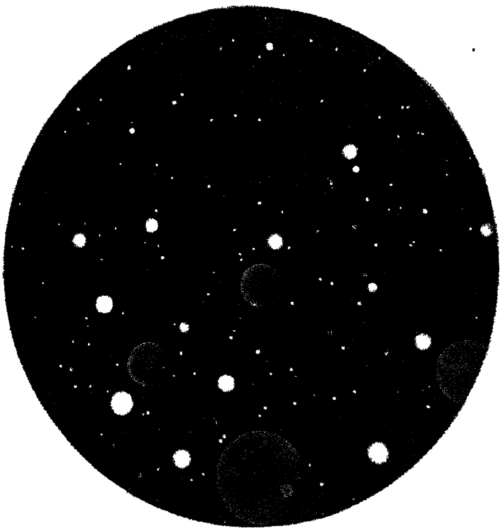


Fig. 20.

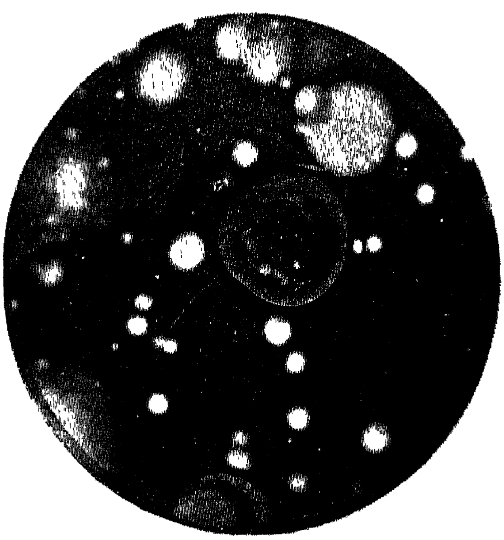


Fig. 21.

Dairy Bacteriology.

Farm Notes.

NORTHERN RIVERS DISTRICT—October.

H. V. JACKSON.

Many farmers will be making up for lost time in getting their maize sown as quickly as possible after the delay caused by the rains; deep ploughing will be found to prove advantageous, and any maize already sown and commencing to show will be all the better for a light harrowing.

Work will be in progress in the cane-fields and sugar-mills. Plant cuttings of cane as soon as possible, and see that it is good clean healthy cane from ratoons.

Arrowroot-growers will also still be harvesting their bulbs, and making arrowroot, if the weather keeps sufficiently favourable. It is not too late to plant out arrowroot, but the work should be completed quickly.

If growing coffee, and anything has been grown as a "green manure," turn the crop in before it gets too advanced, and keep the plantation free from weeds. If the weather is warm and moist, and consequently favourable to planting out, seedling trees from the seed bed may be planted where it is intended they shall remain, though, generally speaking, it is wise to wait till the tropical rains have set in. Carefully shade the seedlings until established, if you do attempt planting, and if dry weather is experienced, see that the plants are watered. Set apart a small quantity of the ripe coffee berries for sowing a seed bed for future use.

Anyone desiring to save fodder for hay and chaff will have to take the work in hand as soon as the crops are at the right stage—do not wait till the stuff is too dry altogether.

If the weather be hot and dry potatoes will require to be well mulched, but if no suitable stuff for mulching is obtainable then carefully earth them up somewhat. Sweet potatoes may be planted, or cuttings of the vines put in.

Vegetable marrows, melons, cucumbers, &c., should be making good growth and covering the ground by this time. Frequently go through the plots and destroy, as far as possible, and disturb any insect life likely to do damage; at the same time do not allow the vines to straggle over the ground too much, but pinch back the tips of the shoots occasionally. Where insects are attacking potatoes and pumpkins and melon vines dust with air-slaked lime or wood ashes frequently.

Rhubarb will require watering if the weather be very dry, and shading will be beneficial; it also will require a mulch of good well-rotted stable-manure.

Do not forget to sow some so-called Madagascar beans *(Dolichos lablab)* ; they are best grown on a trellis or fence. With this bean on your garden fence, and a bed of spinach beet in your garden, you need never be without some green vegetables during the trying dry spells.

Where green fodder is in request, millet, sorghum, imphi, planter's friend, and amber cane should be sown. Keep crops clean and well cultivated.

Be careful to gather French beans so soon as the plants are producing suitable and fit pods, and so avoid having old stringy beans supplied to the household.

Sow French and kidney beans. Plant out egg-plants and tomatoes. Sow red and silver beet, cucumber, vegetable marrow, peas, and tomatoes. Sow a little seed of cabbage, lettuce, parsnip, radish, and turnip.

Banana suckers may be planted, also pine-apples.

Sow cattle melons, also cow peas for green manuring.

Young grape vines will have made strong shoots, and they should be tied up carefully to prevent them being broken by the wind. Spray with Bordeaux mixture; to prepare it take 6 lb. bluestone and 4 lb. lime, mix with 22 gallons of water for winter use, and 40 gallons of water for summer use. This mixture must be made in a wooden vessel. The bluestone should be crushed and put in a fairly porous bag, and suspended in water, not too much below but near the surface. If put into hot water, and left suspended in the bag, it will take about twenty-four hours to dissolve. After being dissolved, make the quantity of liquor up to 20 gallons, before adding the lime. The 4 lb. of lime should be good and fresh. Slake it on a board with a little water; when the lime is finally dissolved in water, put the liquor through a strainer, so that there are not any lumps. It is advisable to have the materials thoroughly dissolved, or the spraying mixture may choke the pump. The lime should be poured to the bluestone, not the bluestone liquor to the lime.

Spray deciduous fruit-trees with Paris green, and look out for borers in the limbs and branches. For aphis on fruit-trees, especially on orange-trees at the present time, use resin and soda mixture.

For mixing Paris green, a small quantity may be made by taking 1 ounce of Paris green to 10 gallons of water and a little soft soap. Mix the Paris green first of all in a cup or tin like a paste, as if making mustard. Keep well stirred while using. Paris green is very poisonous, and it must be handled with caution. Particulars of insect and fungus diseases of fruit and the remedies, by Messrs. Allen, Guthrie, and other Departmental officers, may be obtained in pamphlet form from the Government Printer; price, 1s. And care should be taken to follow the directions for mixing, as not only are improperly prepared sprays ineffective for the pests it is desired to destroy, but may injure the trees into the bargain.

See that pig-pens are kept clean. Put a little charcoal in the way of the pigs occasionally; or, better still, powder some charcoal into the milk that is served to them now and then.

Wash out and cleanse feed troughs that are used by all animals, and so remove fermented and smelling matter, which may contain the germs of disease.

See that the hands are absolutely clean when milking. Dirt conveyed into the milk from this source is one of the means whereby milk is tainted, and far too little attention is given to this item of cleanliness. The men while milking should not be smoking and expectorating.

A correspondent writes asking what is the disease called rickets, which he has seen mentioned in some newspaper. I cannot say anything on the subject, if it refers to some complaint in his locality, and he had better consult a veterinarian; but in England a disease known as rickets in stock is a weakness or disease of the bones of young cattle, due, probably, to a lack of proper nutrition. Calves a few weeks old show it by enlargement of joints and bending of the limbs. The bones are soft, and not capable of bearing the animal. Phosphate of calcium, once daily in the food, is given to young calves—from 1½ to 3 drachms. The food served to the animal should be good and nutritious.

[In the *Agricultural Gazette* for March, 1893, page 158, there is an article by Mr. F. Turner on the Zamia palm and its relation to a disease in cattle called rickets. The same matter has been just recently engaging the attention of the Stock Department, and it is hoped that a report will shortly be available for publication. In the *Gazette* for August, 1898, page 859, there is a report with respect to an affection of cattle in the Port Macquarie district, caused, it is thought, through eating the shoots of grass-tree after rain.—ED.]

RIVERINA DISTRICT—OCTOBER.

G. M. McKEOWN.

Sorghum.

Seed of this fodder-plant should be sown without delay in well prepared land. Low lands on the river frontages will give the best results, and where practicable irrigation should be applied.

Seed should be sown in drills about 3 feet apart, to admit of tillage being carried out during the growth of the crop. About 10 lb. of seed to the acre will be sufficient. Planter's friend, Amber cane, and Kaffir corn will give the best results.

Maize

may still be sown to produce a crop for green fodder or ensilage. River flats deeply worked will produce the most satisfactory crops.

Seed should in all cases be sown in drills and light cultivation be continued during the growth of the crop.

Cow Pea

should be sown in drills 3 feet apart, with the seeds about 6 inches apart in the rows.

The black and clay-coloured kinds are the best.

Millet.

Hungarian for hay or green fodder may be sown in finely pulverized soil. Seed 15 lb. per acre.

Pumpkins and Squashes

should be sown as early as possible in deeply worked land. Pumpkins should be sown 10 feet apart, two or three plants being left in each group. The bush squashes and the shorter running varieties may be sown at a less distance apart.

Manure liberally and mulch well to retain moisture.

HAWKESBURY DISTRICT—OCTOBER.

GEO. VALDER.

Maize.

THE heavy rains experienced during the latter end of August and beginning of September were followed by fine, warm, sunny days, and as a result farm operations have been very extensive. In many parts the early crops are well above ground. The weeds also are coming up very strongly, and therefore the early-sown maize crops should receive a good share of attention, being either harrowed or lightly cultivated between the rows in order to check the weeds and assist in retaining the moisture in the soil. I would strongly advise shallow cultivation for maize, more especially with the early crops. During the moist weather in spring the young plants send out large numbers of roots at shallow depths, and these are to a great extent disturbed by deep cultivation, and the yield is often thereby much reduced. If, however, the seed is planted at the bottom of the furrow, and the land is well harrowed as soon as the young plants are a few inches high, no harm will be done to the plants, as their roots are at a safe depth ; but the weeds will be destroyed, and the soil left in good condition.

Seed Maize.

Last season I mentioned that complaints about the difficulty of obtaining pure seed were widespread, and I am sorry to say the same trouble continues. As I have already pointed out in these Notes, maize is, perhaps, more prone to cross fertilisation than any other cereal; hence, if the farmer grows more than one variety, there is always a danger of mixing. This danger, it is true, can be mitigated on large estates by planting each variety some distance apart; but even then there is still danger of mixing, as the pollen is carried long distances by bees, and also by birds. I would strongly advise farmers to set aside portion of their maize land for growing seed, choosing a position as far removed from other maize crops as possible. Sow and cultivate this carefully, and when the crop is ripening go carefully along the

rows and cull out any of the plants that are not true to the type, and those that do not bear well. When the crop is harvested, cull out any of the cobs that are not well-formed or appear to have been crossed. Also, when the corn is shelled, sift out the small grains, and sow only the large plump seed. If this system of selection is adhered to, the variety will not only be kept true to type, but it will be improved both in yield and quality. Other causes of deterioration are the use of immature seed and the growing of the same crop year after year on the same land. The plants intended for seed should be allowed to thoroughly ripen before they are harvested. As maize will stand longer in the field than any other cereal, the plants can nearly always ripen their seed in the field without its being injured. Change of land and seed can be obtained by getting a farmer in another district, where the climate and soil differ from your own, to cultivate a small quantity of the variety or varieties you are raising for a year or so, and then exchange seed with him. Exchanging seed will in many instances improve the crops, and therefore benefit both of the growers. There is, again, a large demand from the farmers in the inland wheat-growing districts for early-maturing varieties of maize. During the ploughing season maize is used extensively for horse-feed by the large wheat-farmers. This maize often costs a fairly high figure, as to the market price must be added in many instances heavy charges for freight and cartage. In most of these districts only quick-growing varieties can be successfully grown, and so far the following varieties appear to have given the most satisfaction, viz., Ninety-day, Queen of the Prairies, Early Leaming, Abercrombie, and Early French. The listing system should be adopted, as in nearly every season when the rainfall is not very large, crops sown on this system give by far the best results.

Sorghum.

The main crops should be sown this month. Sorghum can often be successfully grown on lands that are too poor to grow corn. Although it is generally regarded as a heavy feeder, it often can be grown in rotation with corn or other cereals, as it is a deep feeder, and if not grown more than once on the same land leaves the soil in good condition for corn and other surface-feeding cereals. Sorghum endures drought much better than corn, and is grown successfully in many districts of the Colony where corn in most seasons would fail. Although not as good a forage as corn for milch cows, it yields a very heavy crop, and resists drought, and is, therefore, valuable to dairy-farmers.

Broom Corn or Broom Millet,

if not already sown, should be put in at once. The ordinary maize drills are very suitable for sowing the seed, using only a very small quantity and distributing it evenly along the drills. It succeeds very well in this district, and should be a valuable crop if carefully cultivated and harvested. There seems to be a good demand for the heads, as numerous inquiries are received by the Department from manufacturers for it every season. Indeed, owing to the failure of

American crops, manufacturers have been at their wits' ends this year to obtain a sufficient supply, and the Department have received offers of over £30 a ton for this product. Besides the "fibre," a very large quantity of seed is produced, and it is a first-rate feed for pigs and poultry. Now that the prospects of an enormous export trade in poultry have safely passed beyond doubt, it will be well for farmers who intend devoting more attention to this branch to pop in little plots of stuff like broom millet and so on in the odd corners that now harbour weeds, and so always have on hand plentiful supplies of varied food for the fowls. The cultivation required is the same as that given to maize or sorghum.

Leguminous Forage Crops.

It is very necessary that more attention should be given to these crops if the farmer wishes to keep up the fertility of his soil; and to the dairy-farmer they are also of great importance in enabling him to feed a complete ration to his cows at a low cost. Professor Robertson, the Canadian Agricultural Commissioner, some time ago published a report, in which he states, that "after years of seeking for a perfectly balanced ration of ensilage for dairy cows, the combination which he has found will give cattle all the nourishment required, at a cost much less than that of ripened cereals or concentrated by-products, is that of maize, horse-beans, and sunflower heads." Now, in all our chief dairying districts maize and sunflowers can be successfully grown as summer crops, but horse-beans can only be grown successfully as a summer crop in the cool parts of the Colony. We shall, therefore, require to find some leguminous fodder crop to take the place of the horse-beans. Cow-peas have proved very successful, both as to yield and quality of the forage; but unfortunately the crop is an expensive one to harvest, and the vines do not pass very readily through the chaff cutter. Lucerne, it is true, answers well, but the dairy-farmer also requires an annual which he can rotate with other forage crops. In the United States the soy-bean has come largely into favour for this purpose. Although, so far, it has yielded rather uncertain crops in this Colony, I believe that we shall discover one or two suitable varieties among the large number under cultivation. Being an upright grower, it can be cut for forage with a mowing machine, and is easily harvested in every way, besides chaffing well.

Worn-out maize lands can be vastly improved by sowing a crop of cow-peas, and feeding them off with pigs. Tangier-peas, mung-beans, &c., are also suitable for this purpose, and sowings should be made this month. The Lima bean should also be planted, either as a field crop in drills, or as a garden vegetable on trellis. Splendid crops of this bean have been grown in various parts of Central Cumberland, and in every instance the growers state that it was one of the most prolific and useful vegetables that we have. It should certainly be grown on a large scale, as if all the beans are not consumed when green, they can be allowed to ripen, and the dry beans are most valuable for winter use.

Where pigs are kept, it is a splendid idea to have a plot or two of cow-peas, or other leguminous crop, to turn them into. The cost of such a system is the ploughing of the land and the sowing of the seed, with, perhaps, a bit of attention in the way of a couple of cultivations. The return is healthy, rapidly-fattened pigs, and a paddock enriched by the droppings of the pigs and the residue of the crop.

Pumpkins and Melons,

if not already sown, should be put in as soon as possible. The crops that are above ground should be well cultivated and thinned out. Preserving melons are wonderfully prolific, and although not of high feeding value will be found extremely useful for winter feed, especially if pulped and fed with chaff, cattle and sheep thriving well on them. They are also useful for feeding to pigs. For beetles and bugs spray with Paris green, or dust the plants with lime.

Root Crops.

Potatoes, mangolds, sugar-beet, &c., should now be well above ground, and require careful cultivation, in order to retain the moisture in the soil. Sweet-potato cuttings will soon be ready for planting out. Choose a piece of light sandy soil, give this a deep and thorough ploughing, bring the soil to a fine tilth, and then plough up ridges 4 feet apart. Plant the cuttings along the top of these ridges, about 1 foot to 18 inches apart. Keep the soil between the rows free from weeds, and the sweet-potato plants will soon cover the ground, and in most seasons produce a heavy crop of tubers and vines. In another part of this issue Mr. Guthrie has something to say about manures for these crops.

Cotton.

Some few farmers in this district have taken up the cultivation of cotton on a small scale, in order to give it a trial. As a rule, the early-sown crops give the best results. The seed should be put in as soon as the soil is warm enough to cause the seed to germinate quickly, and the young plants should receive constant attention, the weeds being kept down by frequent shallow stirrings of the soil. Later sown crops are liable to be injured by drought; the young plants require to be kept growing, and if checked, always suffer badly, and the yield is generally much reduced.

Haymaking

will commence this month. Farmers should see that their binders or mowers are in thorough order. The haymaking season is, as a rule, a very short one, and it is necessary that there should be as few delays as possible in the cutting. In this district the hay is sometimes rather slow in curing; it is best, therefore, to make the sheaves small.

Orchard Notes.

W. J. ALLEN.

OCTOBER.

ALL ploughing should be completed by now, and after each rain the orchard should receive a good cultivation in order to keep the surface well pulverised and, as far as possible, prevent evaporation. If the soil in the orchard is very heavy, be sure and run a smoother or harrow over as soon as the ploughing is completed to prevent the soil from drying and leaving the orchard very lumpy, which is anything but a desirable state.

Since the wet spell which was experienced in the coastal districts some weeks ago, many orchards have not been ploughed or stirred in any way, and in consequence weeds have taken possession of the land and have grown apace, and in many instances are already coming into flower. I would urge fruit-growers to have these turned under as soon as possible, as if covered while quite green they will be of some use as a green manure; but if, on the contrary, they are allowed to go to seed, they not only impoverish the soil, but supply seeds for future crops. By this neglect the land is becoming baked and hard, and the moisture which it is so necessary to conserve is being lost, and I fear that, should this season prove as dry as last, these neglected orchards will be in a worse condition than they were a year ago, notwithstanding the fact that we have had splendid winter rains, which have saturated the subsoil as well as the surface. With proper cultivation the trees should easily stand the coming season, be it dry or otherwise, without suffering, and carry and mature good crops of fruit.

From present indications the crops of deciduous fruits will be very fair, and I trust that pruning has been carried on with a view to preventing the trees from overbearing—that is, by cutting out all long, weak growth.

If the trees should set a heavy crop, they can certainly be thinned; but from past experience I fear that this important part of the orchard work is very often neglected. It would be well to try root-pruning on trees which frequently lose their crops. In some of the warmer districts the Bartlett (or Williams' Bon Chrêtien) pears do not set good crops, in which case it would be well to try pruning when the trees are in bloom. Both apple and pear trees should be bandaged for codlin moth towards the end of the month, and these bandages attended to every week; also, when the fruit is set, I would recommend spraying all apple and pear trees with Bordeaux mixture (summer solution), with Paris green added in the proportion of one

ounce to twelve gallons of Bordeaux, recipe for which is given in the pamphlet on "Insect and Fungus Diseases of Fruit Trees," recently published. This spraying is equally effective for scab and other fungus diseases as well as codlin moth.

Aphis on peach-trees will have to be closely watched, and trees sprayed as recommended in abovenamed pamphlet.

Strawberries should receive special attention when they are attacked by leaf blight, rust, mildew, etc. Spray the plants with Bordeaux mixture as soon as the growth starts and again when the first bloom opens. Sulphur, if dusted on the leaves and between the plants, will prevent mildew. I would not recommend the planting of strawberries where sufficient water is not available, as without plenty of moisture strawberry culture will never prove successful. The land should be well drained, and fairly rich in humus, potash, and phosphates.

Where passion-vines are to be planted, the work should be pushed forward as early as possible, so as to enable them to get a start before the dry, hot weather sets in. Keep a strict watch on all refills, and, if they show signs of wilting, give them one or two buckets of water from time to time until they get a good start.

Disbud all newly-planted trees, leaving good shoots at least 4 inches apart along the trunk of the tree, and do not allow two or three shoots to start from the same place, as so many have done, but give each branch a separate hold of the main stem.

If the sap is well up, citrus trees may be successfully budded this month. Keep all dormant buds and grafts well disbudded, so that the bud may get away good and strong. No suckers or shoots should be allowed to grow below the buds. It is also very essential that stocks should be cut back properly. The cut should be slanting, being slightly lower on the side opposite to the bud, and it is advisable to stake them, not only to prevent their being blown out, but to encourage a straight trunk. Where grafts have been put on old trees they are even more liable to be blown off than small ones and must be tied to prevent it. To do this, a good stake should be tied to the branch grafted and allowed to project a foot or more over the end; then, as the graft grows it can be tied to it. While working around trees, watch for borers on the trunks and branches, as when they start their work it is very easy to cut away the bark and find them—in this way keeping the orchard clear of this pest.

If the spring should prove a dry one, it is well to watch all refills in the orchard, and if these show signs of wilting, give them one or two buckets of water from time to time.

As soon as the vines begin to grow, sulphur them at least once before blooming, for mildew, and twice if the weather is very damp. In the coastal districts it is well to spray them immediately with Bordeaux mixture, and, should caterpillars of any kind be eating the leaves, add Paris green to the solution in the proportion of one ounce to twelve gallons. Repeat the sulphuring from time to time, giving as many as eight applications if the season is at all damp. This will pretty well keep oidium in check. Keep all vines well disbudded.

I have noticed in many small vineyards that this important work is very much neglected. Never allow any branch to grow below the crown of the vine. To do this work properly it will be necessary to disbud all vines from twice to three times.

REFERENCE TO COLOURED PLATE.

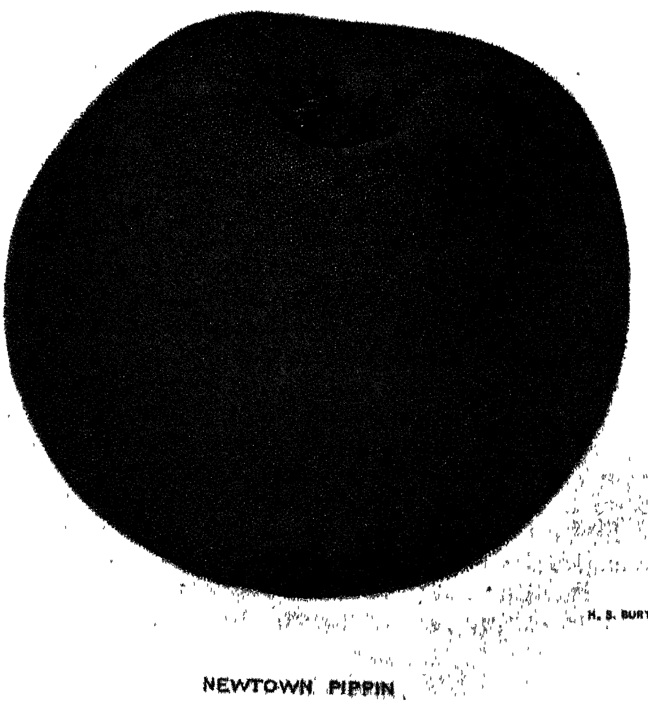
Sturmer Pippin.—A first-class old English variety of medium size, roundish and somewhat flattened and narrowing towards the apex. Skin of a lively green colour, changing to yellowish green as it attains maturity, and almost entirely covered with brown russet with a tinge of dull red on the side next the sun. Stalk ¾ of an inch long, straight, and inserted in a round, even, and russety cavity. Flesh, yellowish, firm, crisp, very juicy, with a brisk and rich sugary flavour. Ripens late, will keep for a long period, and ranks as one of the best dessert apples, and is suitable for export. Tree hardy, thrifty, and bears freely.

Newtown Pippin.—A well-known and popular variety, of American origin, with medium-sized, roundish, rather irregular and slightly ribbed fruit. Skin at first dull green, but changing as it ripens to a fine olive green or greenish yellow, with a reddish brown tinge next the sun, and dotted all over with small gray russety dots and tracings of russet near the stalk. Flesh, yellowish white tinged with green, firm, crisp, very juicy, and with a highly aromatic flavour. Ripens late, and may be kept for a long period; is a first-class dessert apple, and also suitable for export. Tree fairly vigorous and a moderately good bearer in our colder districts.

CUTWORMS.

THE vast amount of damage done to the onion crops in New York State by cutworms has led to a series of experiments to demonstrate the most effective method of destroying the stealthy marauders. The results are issued in a special bulletin, and it appears that they tried spraying the onion with a mixture of pulverised resin 5 lb., fish oil or any animal oil 1 pint, concentrated lye 1 lb., mixed with 5 gallons of water, and then 1 gallon of this used in 160 gallons of water. They also tried spraying at night with kerosene emulsion, but both these methods proved unsatisfactory in many respects. A bait made of bunches of freshly-cut grass dipped in a solution of one part Paris green to eighty parts of water, and another made of 1 lb. of Paris green to 50 lb. of bran, moistened, did not prove of as much value as a mixture of bran, or equal parts of bran and middlings mixed as above with the Paris green, and applied dry. This can be sown in drills along the outside of the field to trap and kill worms if they come from other fields; it can be easily and uniformly applied with the onion-seed drill; it can be sown in drills alongside the rows of onions, and the labour required is much less than that of mixing with water and ladling it out in piles. For other garden crops, such as tomatoes, egg-plants, sweet potatoes, cabbages, &c., it is advised to use a tablespoonful of bait about the base of each plant after it is transplanted, and when possible it should be scattered over the field a few days before the plants are transplanted. Much of the damage usually attributed to bandicoots and hares is due to cutworms. In fields that are really badly infested it is said that a change to a millet crop for a season will be of great benefit.

STURMER PIPPIN.



NEWTOWN PIPPIN.

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of October.

Vegetables.

Hot winds sometimes occur during October, and if they should prove severe are likely to have an injurious effect on plants.

The surface soil should be well worked between the rows of vegetables, and if a heavy mulch of farm-yard manure be spread, so much better will be the chances of vegetables thriving.

Under favourable conditions vegetables should be abundant for the next few months, for the tender kinds like French beans, tomatoes, sugar-maize, should be in full bearing.

Beans, French or Kidney.—This vegetable is of the greatest value for summer, and a succession of plants should be kept up by sowing seed in moderate quantity occasionally during the month. Different varieties should be experimented with, both of the dwarfs and runners, including the scarlet-runners and snake-beans. The application of lime to the soil, or gypsum, will be found of much benefit to beans. Superphosphate of lime or bone-meal will, either of them, be a useful addition to ordinary farm-yard manure. Sow the beans in rows, about 2 feet 6 inches to 3 feet apart, or even more, according to the height to which the variety sown is likely to grow. Make drills about 3 to 4 inches deep, and drop the seeds from 4 to 8 inches apart, then cover over with the soil taken out of the drills. After this, walk over the rows, and press down the soil with the feet, and complete the work by raking over the whole bed to make it tidy. Tall-growing or runner varieties will need strong, tall sticks, from 6 to 8 feet in height, for the beans to climb up. The usual method of fixing these is by sticking them in the soil on each side of the row, and crossing them at or near the tops, and thus support each other. Sometimes it is found advantageous to sow tall-growing beans in double rows, about a foot or so apart, and then there will be a bean to each stick. Regularity should be practised as much as possible in the vegetable garden, even in fixing up sticks or supports.

Bean, Lima.—This is a most useful bean, and a prolific bearer; but, unlike the French or kidney bean, the seeds, and not the pods, are used. The plants are both dwarfs and runners, and may be treated much the same as French beans, but they will need more space in which to grow.

Beet, Red.—Sow a little seed in drills about 18 inches apart. As the seed of beet takes a long time to sprout or germinate, it is a common practice to hasten this sprouting by spreading the seed

between damp flannel, or bagging of some kind, in a warm place. When seed thus treated is sown, it should be watered well when lying in the drill before the soil is drawn over it, unless the soil is moist; for, if dry, and water be not applied, the seed would very likely perish. When the seedlings are a few inches high thin them out until they stand about 9 inches or 1 foot apart.

Beet, Silver.—Sometimes known as spinach. Sow a little seed, either for transplanting or in drills, where the plants are to stand. The soil should be made very rich, to encourage the growth of the leaves, which are used as spinach.

Cabbage.—Sow a few seeds from time to time, in order to have a supply of young plants on hand for planting out when required. Plant out from the seed-bed a few strong healthy plants, and avoid any that are weak, drawn, or grown in the shade, for such are likely to suffer from removal and will take a long time to recover.

Cauliflower.—Sow a few seeds and plant out a few strong healthy plants. Make the soil rich with old well-made manure, but avoid that which is rank and fresh, if possible.

Carrot.—Sow a little seed in drills in land that has been well and deeply worked. It is not well to apply manure for carrots direct, but land that has been heavily manured for cabbage, cauliflower, or silver beet would be very suitable for the carrots.

Celery.—Sow a few seeds occasionally to keep up a supply of plants. Very few will be needed at a time When the seedlings are 2 or 3 inches in height, plant them out in a well made bed about 3 or 4 inches apart—when they will grow strong and hardy, preparatory to planting in their permanent places. A few plants on hand that may be suitable should be planted in shallow trenches in heavily manured ground. Plant about 1 foot apart in the trenches. When the celery is nearly full grown, the stalks will need blanching to make them white, tender, and eatable. This can be effected by earthing up the soil round the stalks, or in covering the stalks with boards or anything that will keep them entirely from sunlight.

Cucumber.—Sow a few seeds if it is desired to keep up a succession.

Cress and Mustard.—Sow a patch from time to time to keep up a supply. Make the soil very rich and fine.

Capsicum or Chilli.—A few plants are desirable for those who like hot condiments. There are many varieties, being large and small fruits, some of which are very ornamental. Sow seed in box or pot and transplant the seedlings when large enough to move.

Egg Plant.—Grown chiefly for ornament or curiosity in this Colony and not much used or liked as a vegetable. Sow a few seeds in a pot or box and afterwards transplanted. A variety bearing scarlet fruit is extremely ornamental.

Kohl Rabi.—This is but little used as a vegetable, and at best it is but an indifferent one. Those who are curious to try it should sow and plant as the cabbage is managed.

Leek.—Sow a few seeds in a seed-bed. Any plants which are about 6 or 8 inches or more in height may be planted out in shallow trenches. The land should first be heavily manured, for the leek needs abundance.

By planting in shallow trenches it will be easier to earth up the leeks, for they need blanching, than if they are planted on the flat. Liquid manure will be found most useful. Plant deep in the soil.

Lettuce.—Sow a little seed, and plant out from seed-bed any suitable plants that are ready. Keep them going by watering well if the soil and weather is dry, and apply liquid manure occasionally.

Melon, Rock and Water.—Sow seeds in well-manured ground if a a succession be needed.

Okra.—Sow a little seed, and if plants are available, plant them out from 2 to 3 feet apart in good soil.

Onion.—Sow a little seed in drills; keep up frequent cultivation amongst growing onions, and do not allow any weeds to grow amongst them, especially when they are very young.

Parsnip.—Sow a little seed in ground that has been dug about 2 feet deep. The parsnip is a deep rooter, and needs the soil to be friable to a considerable depth.

Peas.—Sow a little seed now and then to keep up a supply of this useful vegetable. Gather the pods whilst they are young and tender, and allow no peas to ripen on the old vines.

Potato.—Plant out a few good, sound, medium-sized potatoes, free from potato-scab or moth. Manure well, and take care that the soil is well drained; plant about 6 inches deep.

Pumpkin.—Sow a few seeds if sufficient have not already been sown.

Radish.—Sow a small quantity occasionally.

Rosella.—Suitable only for the warmest and most moist districts of this Colony. Sow seeds in pots or boxes, and when the seedlings are large enough plant out.

Rhubarb.—Sow a little seed if plants are likely to be required.

Tomato.—Sow seed and plant out from previous sowings.

Turnip.—Sow a little seed in drills.

Vegetable Marrow and Squash.—Sow a few seeds if more plants are required.

Flowers.

During October there should be a magnificent display of flowers of many varieties, and in particular roses will be most productive. The class known as hybrid perpetual should now be at its best. The annual varieties, such as the Banksias, continue to bear their flowers, but will shortly be past their prime. When the flowers have dropped off the plants may be thinned out and pruned, for the flowers being produced on old wood it is not desirable to prune in winter or early spring. By pruning them now new wood will grow to bear flowers next year.

Plants of tender habits, such as cockscomb, and all the amaranthus family, balsams, salpigloti, &c., should be planted out without any further delay.

Hedges and edgings of all sorts will need clipping rather frequently in order to keep them in good order. Chrysanthemums may be increased by cuttings from old plants, and when rooted should be planted out.

General Notes.

Denmark: A Lesson.

The official consular report on the trade and agriculture of Denmark for the year 1897 is just to hand, and a casual glance through the facts and figures therein set down reveals an advanced stage of intense farming and stockfeeding calculated to surprise the most sanguine advocate of scientific development of natural resources.

Being an official document, the facts are set down in a cold, unimaginative manner, and it is only when one looks into the figures that the industry and success of the Dane becomes evident.

We find that the total area of Denmark, including the islands and peninsula of Jutland, amounts in the aggregate to 6,891,051 tonder, equal to 9,396,888 acres, of which nearly 20 per cent. is unfit for pasture or agricultural use, being chiefly bog, moor, and stony ground, seashore, &c. Yet from this little territory, only the size of a few sheep-stations, the following astounding list of dairy produce was exported in one season—1897:—

	Imports.		Exports.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Bacon and Hams ... lb.	8,690,000	166,000	137,940,000	3,110,000
Butter ... ... „	39,490,000	1,628,000	145,329,000	6,628,000
Eggs ... ...score	1,500,000	78,000	12,500,000	728,000
Total	....	1,872,000	....	10,466,000

Of the above exports, no less than £10,000,000 worth went to Great Britain.

It may be noted that the "imports" are really Swedish and Finnish supplies for re-exportation; and, allowing for these, the dairy produce export of Denmark, by itself, represents over £1 per acre per annum for all the available land in the little kingdom.

To attain these results it must not be thought that only natural fodder and native pastures have been drawn upon. The long winter, and consequent necessity for stall feeding, renders the purchase of cattle food on a large scale indispensable, and, accordingly, we find that, in 1896, maize was imported to the extent of 216,071 tons, and that, in 1897, this had risen to 431,250 tons, besides bran, linseed cake, &c. For the improvement of agricultural lands, besides all the natural manures from the cattle, pigs, &c., and those manufactured from offal, Denmark imported 7,000 tons of artificial manures during the season under review, from which it is evident that the value of replacing what the crops take from the soil is fully understood.

Now to consider for a moment how these results are obtained. We note, first, the phenomenal yield of milk of the Danish cows. The Consul says:—"It may be estimated that a fully grown cow, and one that has received ordinary good treatment, will make an average yield of milk of about 3,500 kilos yearly, though 4,000 is not considered extravagant, and even 5,000 to 6,000 kilos is attainable. The yield of milk, say 4,000 kilos, is equivalent to 8,816 lb., or 860 gallons (English) for the year."

This reads like a good record; but if we take the higher figures quoted, 1,300 gallons, as compared with the New South Wales average of something like 300 gallons, we begin to realise what room there still is for improvement in the milking capacity of our dairy herds. It may be of interest to give the following particulars of the origin of the "Red Danish" type of cow, which is universally used in those districts:

"The stock was originally in three types, the Angel breed, the North Ileswick breed, and the Ballum breed, of which the first was the smallest and best for dairying purposes, whilst the third was the largest and heaviest. From these three stocks, and from these alone, sprung the 'Red Danish.' . . . . . The total number of cows of this breed is 800,000."

By a simple calculation, we may compare our results with theirs, thus: Taking the year 1894, the last good season before the late droughts, and we find our dairy stock of New South Wales stated as under (Coghlan's "Seven Colonies," folio 290):—

Number of cows...	438,211
Estimated quantity of milk produced ...	157,755,960 gallons

This estimate supposes an average of 360 gallons per cow; but in the estimate for 1896 we have the average reduced to 270 gallons, which is probably nearer the mark, the number being reduced from 438,000 to 400,000. Taking even the lower figures, however, and allowing the handsome quantity of 10,000 tons for local consumption, we should, if our cows were of the Danish standard, have an exportable surplus of some *23,000 tons*, instead of 3,000 to 4,000. This is calculated, not on the estimated milk supply, but on actual Danish exports for season 1897-8.

Surely, with our open winters and enormous facilities for growing and saving fodder during at least three seasons out of every six, we ought to reach a higher milk standard without much trouble. It is allowed that some of our best cows are able to nearly hold their own even with such averages as are quoted above; but, unfortunately, most of our herds have "got a tail," as cricketers say, and it is to the elimination of this "tail" we must earnestly set ourselves. Next we must endeavour to prevent the excessive waste involved by allowing cows to "run down." It may be laid down as an axiom that it costs more to bring a run-down cow back into condition than it would cost to keep her in full milk all the time.

But to return to Denmark. The increased export of butter for 1897 as compared with 1896 was no less than 5,132,000 lb. on local supplies, and 12,140,000 lb., including the increase on Swedish and

Finnish exports, while of artificial foods imported during the same period there was an increase of 11,000,000 lb. of bran and 77,000,000 lb. of linseed cake.

In bacon and hams, during the years 1895-6 enormous increases took place, and although 1897 gives a reduced amount there is still the respectable total of 138,000,000 lb. exported, or considerably more than the total weight of all the pigs in Australasia at the last estimate —1897.

Eggs show an increase of 2,300,000 score on the preceding year, the local returns showing 12,100,000 scores as the season's export.

The Danish bacon, in some seasons, is complained of, although usually as good as the Irish, and it is thought that the low quality is in seasons when large quantities of maize, more or less damaged, is fed to the pigs. This corresponds exactly with experience elsewhere, and is a strong argument in favour of "topping off" with peas, beans, barley meal or other more highly nitrogenous food instead of maize, which has always a tendency to produce oily fat and hard, flavourless, lean meat.

Bacon-curing, like butter-making, is undertaken to a great extent on co-operative lines; and even when the factories are private property, only a limited interest on capital goes to the owners, the remaining profits being distributed among the suppliers. Bacon is cured largely by the "autocure" process, for which it is claimed that the time of curing is reduced from days to hours, while a quantity of nutritive substances previously lost are kept in the meat. Inquiries are now being made as to this process, and any information obtained will be published for general information.

It is interesting to note, in conclusion, that in Denmark exists a body, in all essential respects based on the lines of the New South Wales Board for Exports, which, by the help of the Danish Consuls and subjects abroad, endeavours to find out new markets for goods and the necessary information about preparation, &c. They go further than we, however, by publishing a sort of national trade circular, printed in three languages, and send representatives out on behalf of the kingdom to introduce goods on foreign markets, at the same time forwarding samples and quotations of products and manufactures, and endeavouring to establish permanent connections.

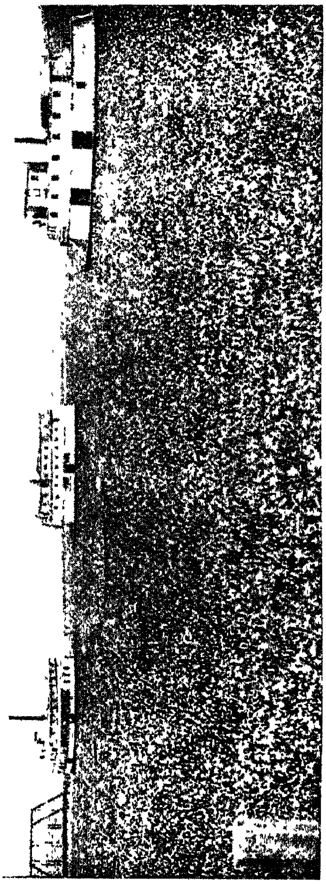
No complaint seems to have been made of "Government interference with private industry," and the Danes seem to be inclined to co-operate as a body without jealousy of each other, and for the common benefit, in placing their little kingdom in the forefront of commercial enterprise and consequent success.

The Water Hyacinth.

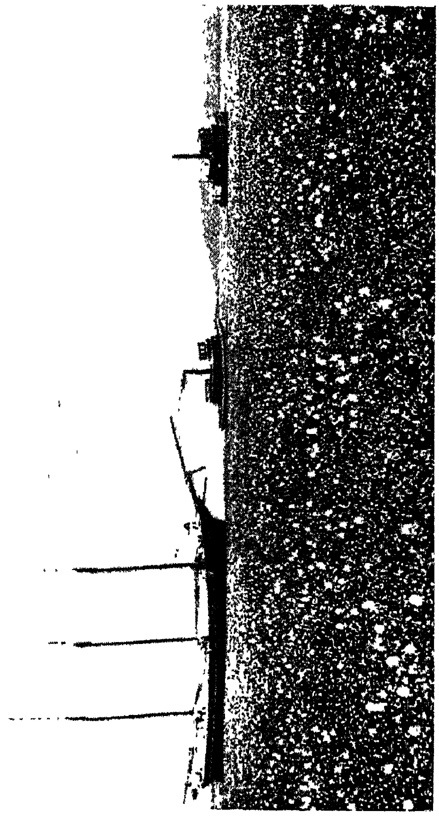
Nearly two years ago, in the *Gazette* for October, 1897, p. 698, Mr. J. H. Maiden, in his Botanical Notes, called attention to the pretty, but dangerous Water Hyacinth, *Pontederia crassipes*, and the possibility of its becoming a pest on our northern rivers.

Those who have only seen this plant in vases or kerosene tins, treated as an ornament on verandahs, and spreading but slowly if

THE WATER-HYACINTH PLANT IN BLOOM.



THREE STEAMERS BLOCKED BY HYACINTHS IN THE ST. JOHN'S RIVER.



TWO TUG-BOATS TOWING VESSEL THROUGH THE WATER-HYACINTHS.

at all, have no idea of what, under favourable circumstances, it may become; and the plates accompanying this, reproduced from the July number of the *Windsor Magazine,* may be of value as emphasising the warning of the Government Botanist.

It is hardly likely that on any of our navigable rivers such serious blocks will occur unless the plant should adopt a fondness for estuarial waters, but a danger of hardly less importance lurks in the near future, in the shape of the choking up of our creeks and consequent diminution of water supplies in times of drought; added to this is the danger of flood waters avoiding the hyacinth beds and scouring out new and dangerous channels in the line of least resistance, with the possibility of changing injuriously the watershed of whole districts.

That these are not fanciful fears the following will show:—Some six months ago I travelled through the northern river district on a lecturing tour, and on my way by sea to Grafton I found that at least two of the passengers carried specimens of the hyacinth in pails. I spoke earnestly to one gentleman on the subject, but he utterly refused to credit the statement that any danger could arise from his beautiful plant. On the following day I was surprised to see, within a mile of Grafton, and in the leading creeks, not specimens, but acres of pontederia in full bloom and with every appearance of having come to stay. I called the attention of the local agricultural society to the matter, but, so far as I know, nothing has been done to eradicate the pest. The serious part of the question is that when in the same district only some five years before, I saw no wild specimens, and but few grown for ornament. Whence the supplies came from to so far have taken possession in such a short time I was unable to find out, but there they are. On the Upper Tweed I found no wild specimens, but at several houses I found buckets and kerosene tins with healthy plants, the pride and pleasure of the owners, who smiled indulgently at my suggestion to burn them up at once.

I saw none on the Richmond River except a small specimen being carefully carried on the boat from Woodburn to Lismore, but from the Clarence River experience I do not hesitate to say that the plant should at once be placed on the list of noxious weeds and exterminated wherever found.

No doubt those who introduced the *Lantana* on the northern rivers deserve the execration of all farmers, but the man who with open eyes will persist in spreading this new pest is committing a crime comparable only with that of the original importers of sparrows, hares, and rabbits.

As instancing the spread of the pest in Florida, I quote the following from Mr. Walter Akroydd, whose article on the subject the photos (by A. P. Lewis, Adrian, U.S.A.), here reproduced, illustrate:—

"It is not definitely known when this plant first made its appearance in the St. John's River, but it would seem that a pond at Edgewater, 4 miles above the town of Palatka, was first infested with it. In 1890 this sheet of water was cleaned out and the plants heedlessly thrown into the river. The sluggish waters of the latter

appear to have been quite as congenial to the plants as that of the pond from which they had been so summarily removed. Settlers and travellers, ignorant of the multiplying propensities of the plant, carried away specimens to grow in the river nearer home to vary the beauty of its existing vegetation."

Within four years the fishermen and steam-boat owners began to suffer from the encroachments of the weed, and the writer proceeds:

"At the present moment the hyacinth infests the St. John's River for a distance of over 200 miles, the banks on either side of the waterway being fringed with a border of the plant varying from 25 to 200 feet in width."

The river at the point illustrated is a mile in width, and is rapidly becoming closed to navigation, and the writer says, "Unless some very drastic method is resorted to for the removal of the hyacinths, the river traffic to Palatka will cease."

This, it is estimated, means a loss to those rafting lumber of not less than £6,000 per annum, besides enormous sums lost in the fisheries, &c., through the hyacinths entangling the nets. Bridges have, during flood time, been broken down by the accumulating masses of the weed, and altogether the report is one chronicle of disaster, the whole, be it noted, having arisen and come to this climax in less than *nine years*.

Although, as has been said, we have not so much to fear for navigation as the St. John's River people, sufficient evidence exists to show that our necessary creeks and waterways are seriously threatened, and that the *Pontederia* should be at once placed under the ban of extermination; the penalty for neglect at this stage being the practical impossibility of coping with the pest when it has once gained a hold, and the certain result of a general spread of this plant being an enormous evaporation from our none too plentiful water supply by the fleshy leaves which are produced in such abundance.

I hope the agricultural societies, especially on the northern rivers, will take up this matter and not rest until stringent measures are adopted for the eradication of the hyacinth.

As far as can be ascertained, the only successful means of getting rid of the plant is by raking it out of the creek or pond, drying and burning, and it should be remembered that, like the prickly pear or the nut grass, the smallest portion will grow and increase in quite a marvellous manner.—J. STEPHENSON, Secretary, Board for Exports.

POULTRY EXHIBITS AT AGRICULTURAL SHOWS.

REFERRING to the minute published in the March number of the *Agricultural Gazette re* poultry exhibits at shows, the Minister desires that it should be known the minute was not intended to imply that subsidy will be refused to Agricultural Societies being or continuing to be in association with the Poultry Club of New South Wales, and selecting their judges of poultry from the list prepared by that Club; or that there is any objection to the inclusion of classes of pure-bred or fancy poultry at the shows of such Societies.

Circulation of Information Contained in the "Gazette."

It is very gratifying to all concerned in the production of the *Agricultural Gazette* that a very large proportion of agriculturists who receive the publication are not content to simply follow out the various suggestions themselves, but do all in their power to induce their less progressive neighbours to adopt the better systems advocated. From one report received from the Manning River, it appears that a recipient of the *Gazette* shares it with six of his neighbours who chat over the various topics, and so derive the greatest possible benefit from the information. This is just what the Department desires, for it is recognised that no matter how sound any instruction may be, there are in every holding differences of soil, situation, &c., which, although slight and perhaps unnoticeable in themselves, all demand peculiar treatment; and it is only possible for the average man to make such allowances after he has had a chance of threshing his subject out thoroughly and grasping all the whys and wherefores in the way it is most likely for him to do in discussion with other farmers.

Results of the Prize Farm Competition at Grenfell.

The competition for a Spalding-Robbins four-furrow plough offered by the Department of Agriculture, and two other prizes offered by the Agricultural Society for the best managed farm in the Grenfell district, has now been decided. Mr. J. L. Thompson, Travelling Instructor in Agriculture, acted as sole judge, and visited Grenfell district on the 30th, 31st August, and 1st and 2nd September, to adjudicate upon the ten farms entered in the competition.

He reports:—"The judging necessitated travelling over 150 miles, and the first prize was awarded to Mr. Henry Myers, Tyagong, 10 miles from Grenfell. This farm comprises an area of 1,421 acres, all conditional purchase taken up from 1867 to 1882. It is all well fenced in with wire and rails, and divided into twenty paddocks, well provided with water from six large tanks and a creek. There are 274 acres under wheat, and 46 laid down with lucerne; the implements used are of the most modern description, comprising digging ploughs with skim coulters, spiked rollers, scarifiers, harrows, seed-sowers, corn-crusher, stripper, winnower, &c. There are 11 draught and 8 light horses, 21 cattle, 1,100 sheep, and 2 pigs.

"The buildings comprise brick dwelling-house of seven rooms, cellar, brick kitchen, and three rooms, outhouses containing five rooms, hay-shed, stables, chaff and wheat barns, underground cemented tank, and other conveniences. The buildings are well arranged and everything kept in the best possible condition. There is also a well kept orchard and abundance of esculent vegetables.

"Mr. Myers' operations have been exceedingly profitable, and although he started with very little indeed, his farm is worth not less

than £5,000, and he only owes about £40 at the present time. This shows what can be done by thrift and perseverance. It will be seen that Mr. Myers obtained 509 points out of a possible 600.

"The second prize was awarded to Mr. Stein, Forwood Farm, 8 miles from Grenfell, who owns 530 acres of freehold land divided into ten paddocks—306 acres being under crops. It is fenced, some with three rails and some with five wires and one rail, with good swing-gates and iron hinges. There is a good underground tank at the homestead, and three large tanks on various parts of the farm, and also a small well-kept orchard.

"The machinery is of the best kind procurable, and ample for the working of the place; the stock comprise 10 well-bred draught horses, 22 cattle, 2 pigs, and 100 sheep. The farm buildings are commodious and in good repair; the land is well cultivated, and the crops are looking exceedingly well, in fact everything is in the best possible condition. Mr. Stein's operations have been very profitable, and he has raised himself to a good position by thrift and industry. It will be seen from the tabulated results that Mr. Stein was awarded 507 points, only two less than the first prize-taker.

"The third prize was gained by Mr. W. Johns, of Warraderry, 14 miles from Grenfell. The area is 2,447 acres of selected land, divided into fourteen paddocks securely fenced with six or seven wires and top rail, and some with an additional barb-wire; there are nine gates and six sets of sliding slip-rails. There is an ample water supply, comprising dams, tanks, creek, &c. There are 520 acres in wheat this year, all looking splendid; most of it was put in by the drill at the rate of about 35 lb. to the acre. There is a small flower garden and an orchard. Mr. Johns believes in having the very best up to date implements and machinery, and he possesses 3 strippers, 2 winnowers, 1 harvester, multiple ploughs, seed drills, harrows, chaff-cutters, corn-shellers, &c. The implements are all carefully housed and taken care of. There are 18 farm horses, 10 unbroken, 5 light horses, and a team of bullocks for pulling down trees, &c., also 5 milch cows, 9 yearlings, 5 calves, 1 Jersey bull, 7 pigs, and 1,300 sheep. The farm buildings are numerous and in good repair. Mr. Johns has a fine working-family, and there is no doubt that he owes his success in a great measure to their efforts; he is building up a most valuable estate and his efforts have been very successful.

"The next in order of merit is Mr. James Newman, 8 miles from Grenfell, who holds 5,000 acres conditional purchase land, and who received 492 points.

"It will be seen by referring to the tabulated list where the others have failed. There can be no doubt that competitions of this kind have a good educational effect. I received great assistance from Mr. Halls, the President of the Society, and also from Mr. Cousins, the Secretary, who accompanied me throughout the whole of my inspection. The crops round Grenfell are looking well and some are very forward, but more rain is yet required to ensure a good season.

"I attach a full scale of points as arranged by the Committee, and the points awarded to each one can be clearly seen."

	General management, with a view to profit.	State of crops, cleanliness, and cultivation.	System of cultivation.	Number and condition of subsidiary aids.	Condition of fences and gates.	Conservation of water.	Machinery, kinds of implements, and condition.	Means used for conserving fodder.	Productiveness of crops.	System of manuring, and conservation of manure made on farm.	Class and condition of stock.	Character and condition of farm-house and buildings.	Any new point of commercial interest relating to crops.	Laying down grasses.	Maximum number of Points.
Maximum marks... ...	100	80	45	40	45	40	60	40	30	20	40	30	20	10	600
1. Henry Myres, Tyagong ...	94	75	40	35	40	35	55	20	24	10	35	28	10	8	509
2. John Stein, Forwood ...	95	75	41	33	42	35	55	18	26	10	36	28	13	...	507
3. Wm. Jones, Warraderry...	94	74	42	31	38	35	58	18	23	15	32	26	12	...	498
4. John Newman, Inglevale	90	73	42	30	40	35	56	15	25	8	35	25	10	8	492
5. Andrew Shaw	90	75	40	30	38	35	55	20	22	15	32	23	15	...	490
6. Peter Cramb, Strathearn...	93	72	36	25	43	35	55	20	25	14	38	20	5	9	490
7. W. W. Priddle, Glenelg...	94	74	36	25	40	35	55	20	20	10	30	28	10	8	485
8. Patrick Madden	94	74	40	20	37	35	53	18	25	10	33	24	10	4	477
9. P. J. Cleary	94	75	40	15	36	35	55	17	26	10	33	25	10	...	471
10. Walter Ingrey	92	70	38	25	30	35	50	15	23	8	34	23	10	...	453

Celery Culture.

It is a matter of frequent complaint that much of the celery obtainable in Sydney market is but miserable, stringy stuff, altogether different to the great snowy, sweet, and crisp plants that one at times finds at homesteads of farmers who hail from the old country. It is certainly surprising that some one does not go in for the culture of this crop systematically; the demand even for the wretched stuff that goes under the name now is enormous nearly all the year round for salads and soups, and so on, and much more of it would be eaten if people who entertain vague suspicions as to the conditions under which the Chinese gardeners raise crops, could feel assured that this and other vegetables that are eaten raw were grown and brought to perfection by wholesome methods.

Some day, perhaps, truck-farming will become as important an industry in this colony as it is in some of the American States, and then we will be able to acquire, without trouble and long journeys, the quantities of absolutely fresh and wholesome vegetables that our climate demands.

Meanwhile, it is just as well for those who care to test the possibilities of cultivating first-class vegetables for the market to take a leaf out of the American truck-farmer's book and study his methods.

The authorities of the Maine Experiment Station have issued a report on celery culture, from which the following information with respect to best methods of cultivation, handling, blanching, and storing is taken:—

Soil.—The best soil is a deep black muck with an open, porous subsoil. The famous celery beds of Kalamazoo are of this character, often so soft that all the work must be done by hand. They retain moisture well, and are usually so situated that the moisture can be controlled by irrigating ditches, and they are easily worked. The soil should be 16 or 18 inches deep, and a heavy clay subsoil at less than that depth should be avoided. There is much such soil in the low meadows of every locality and almost every farm, and while now considered almost worthless they could be made very profitable. But it can be grown upon uplands where soil is deep and rich, and on the upland it is more solid, keeps longer, and is less liable to suffer from frost. The soil need not be ploughed deep, but should be very thoroughly pulverised, as the roots run near the surface.

Fertiliser.—The fertiliser used should be rich in nitrogen, and stable manure is usually preferred, as it also improves the mechanical condition of the soil. From 30 to 60 two-horse loads per acre, ploughed under to a depth of 5 or 6 inches, may be used, and it should be well rotted. Where the manure supply is limited some make a trench 6 or 8 inches deep, and put in this about 3 inches of manure, covering then with soil before setting the plants. If stable manure is not to be had easily, celery can be grown on concentrated fertilisers, if occasional crops of leguminous crops—clover, peas, lupins, &c., are ploughed under. Nitrate of soda is

especially valuable. An occasional application of lime or gypsum will benefit land which has received large amounts of stable manure.

Sowing and Transplanting.—For early celery sow the seed in a mild hotbed, or in flats in the greenhouse from March 1 to 15 (in America). Cover not more than one-sixteenth of an inch, and keep the soil moderately moist but not too wet. It is also well to soak the seed in warm water for a few hours before sowing, and some cover with boards or paper until they are sprouted. An ounce of seed should produce from 5,000 to 10,000 plants, according to how they germinate. When large enough transplant into rows about 3 inches apart, and a half-inch apart in the row, and harden them off by gradual exposure before the final setting in the field. These should be ready to set in the field in three months. For a later crop the seed may be sown out of doors from the middle of April to June 1, according to whether fall or winter celery is wanted. Growers prefer for this to sow plants in a well-made seedbed and transplant as above, to sowing where the crop is to grow. They should be fit to set in the field early in July, and are usually placed in rows 5 feet apart, and 6 inches apart in the row. All cultivation between the rows should be shallow, as the roots soon fill the space between them.

Hilling.—One hilling around the plants before banking is sufficient, which should not be done until the plants have thickened considerably, as the stalks grow tall very rapidly without growing larger. When ready to do this cultivate deeply between the rows, and draw the soil up around the plants, not more than to one-third of the height of the plant, just enough to straighten the stalks and keep them upright. If soil is in good condition it is not often necessary to pack the earth around the plants by hand.

Blanching.—The early crop should be ready for blanching in eight or ten weeks after transplanting, and for this boards are preferred to earth, as it can be done quicker, and the plants are not as liable to rot. Place boards about a foot wide along each side of the row, with one edge close to the plants, and then raise them up and clamp them together. The plants should be blanched enough for use in ten days or two weeks. These boards can be then used for other rows so as to keep up the succession. Boards may also be used to partially blanch the late fall crop, but it is better to finish with earth, especially such as is likely to be left until after very cold weather comes. That intended for winter market is not usually blanched until it is put in storage, but should be well hilled up to keep the plants upright and compact.

Storing.—If the crop is not to be stored long it may be kept in a cool cellar or pit, setting the plants very closely on a loose, moist loam. To avoid heating, make compartments about 2 feet wide by setting up boards which shall come to the tops of the plants when in place. Thus divided, they are less liable to rot than when packed in larger bodies. While the moist and loose loam is desirable to prevent wilting, the foliage should always be kept dry to prevent rotting, and it is important that the temperature should be kept as low as possible, unless it is desired to hasten the blanching.

Fowl Tick.

The following letter from Mr. C. W. Bowyer Smyth will be of interest to poultry keepers:—"I notice in the last number of the *Agricultural Gazette* (August) a reference to the above poultry disease, and one that may be properly termed the worst that can enter a fowl-yard. The remedies given by Mr. McCue are doubtless good as far as they go; but, from personal experience of them, I venture to say that the only certain cure for them is to dispose of the fowls, pull down the poultry house and fence, if made of slabs, also fell any trees that may be in or adjacent to the yard, and begin *de novo*. Further, if the yard is in the back portion of an ordinary-sized cottage allotment, as very many are, and your immediate neighbours keep tick-infested fowls, as very many do in a tick-infested town, then the chance of keeping your own free of them is remote, even assuming that every precaution be taken. My own experience of them is this: I kept poultry in a small yard, partly wire, partly slab, the house of which was tick-infested when I went to live in the place. In due time most of the fowls died, in spite of the fact that I attacked them (the ticks) in every possible direction. After allowing the yard to remain unoccupied for one winter, I again stocked up, but with the same result. Finally, I pulled the house (of wood) and all down, when I discovered literally swarms, small heaps, of them, and in places where I noticed it would be difficult for the all-searching kerosene to reach. I may say that my allotment had vacant land all round it. Being determined to keep poultry, and, if possible, without ticks—my friends said I could not—I began *de novo*, and erected a yard of 6-foot wire netting on the adjoining vacant land, with a new house in the centre of it. I examined minutely all new poultry submitted for purchase, and some of which had to be declined, being infested. I have never seen a tick in the new yard. However, I had one narrow escape. To oblige, I lent a friend a broody hen; in about a month or so she was returned, when it occurred to me to examine her, when ticks innumerable were discerned on her. She was destroyed at once. If the bark of a living tree in or near a tick-infested yard be examined, it will, as a rule, be found full of them. Their habits, appearance, and odour, when crushed, appear to me to be undistinguishable—or, at least, to the unscientific eye, and, shall I add, nose—from the human bug; and I am not sure that they will not find their way into human habitations in search of that which they may consider to be more tasty food. Perhaps one of your scientific readers will pronounce an opinion on this."

Mr. Froggatt, to whom this communication was referred, says:—"As most of the country or suburban fowl-houses in tick-infested districts are run up anyhow, made of odds and ends of timber and old iron or bark, it is almost impossible to get the ticks out when once they are badly infested. In a house built to keep ticks and lice out, and easy to clean, it could be done, as your correspondent shows. The fowl ticks (*Argas*) have habits very much like the common house bug; they dislike the light, feed at night, live in dirt, and can live for

months without food, and, of course, come from eggs deposited in countless numbers in cracks and crannies. They differ, however, structurally in having eight legs (bugs only have six), and quite a different mouth and head.

"It is not unlikely that they might find their way into the house some day, for a closely allied species known as 'bite the stranger' by the natives is well known in houses in some parts of Central Asia, and its bite is said to frequently cause typhoid fever."

Rhea or Ramie.

The *Tropical Agriculturist* has received from Mr. D. Edwards-Radclyffe, of Hythe End Mill, Staines, Middlesex (England), the following letter with respect to experimental work carried out in the manufacture of ramie cordage and fabrics:—

"When we started with ramie we were confronted with the following difficulties:—1st. supply; 2nd. decortication; 3rd. preparation; 4th. spinning; and lastly, demand or market. I will deal with these *seriatim* later. Ungumming, which had hitherto proved such a fruitful source of difficulty, had long been overcome by us; the gum question presented no terrors or difficulties; by our method ungumming is simple and the durability of the fibre is unsurpassed, as is proved by the yarns which have been in use now three years. They are as strong now as when first prepared. I refer to those made at Staines. I have products prepared by our process which have been in use ten years and are as good now as ever. I will deal with the obstacles as they appeared at the initiation of our works at Staines.

"*Supply.*—There is a vast supply in China, where the natives have cultivated it and all the best textiles are made from it. The wealthy Chinese hold it in high esteem, and it fetches high prices. Very small quantities compared with the vast crops grown, unfortunately, have yet found their way out of China. We have based our calculations on the price of raw material at £30 per ton, and at this price I can show a paying industry competing with flax, but I am promised contracts as low as £20 per ton. This will open up a vast field, and enables us to compete with cotton. India produces vast quantities in a wild state; these will have to be brought under cultivation. Dr. Morris, of Kew, recommends ramie to the planters who cannot make sugar pay. It would be a boon to our West India colonies. The Australian colonies are growing ramie; Queensland and New South Wales have sent us splendid quality. The United States Government are recommending it to their farmers, and the Government has voted $145,000 to the establishment of experimental plantations. Mexico, it appears from a Consular report, shows 145 per cent. profit in ramie-growing. From South America I have splendid samples; as many as four crops in the year are cut, and I am promised regular supplies at a price which will put ramie on the market as a competitor to cotton. There is a vast field in Egypt and Soudan. The Government of Natal is recommending ramie-growing. Plantations are already started in Borneo, Ceylon, Straits Settlements, Formosa, Java, and the Malay Peninsula; Corea

produces splendid ramie, and the Japanese are turning their attention to ramie-growing. In short, I hear from all quarters of the globe of the great advance in ramie-growing, and I have not the slightest doubt it will prove a strong rival to cotton. To our colonies I would suggest ramie-growing, and, by the use of decorticators, ribbons could be prepared whilst in a green state; for the ungumming process and filasse should be prepared on the plantation. It is a simple operation, and the plant would not be expensive. The filasse so produced would be far superior to that produced from the dried ribbons, and, in addition, there would be a great saving in freight. The waste products, viz., the leaves and lateral shoots, would produce an invaluable pulp for high-class paper making and command a high price.

"*Decortication.*—In China this is accomplished by hand labour. The operator strips the ribbons from the stem and scrapes the fibre, removing the pelicule or brown bark and much of the pectose gummy matter whilst in a green state. The natives of India merely strip the plants, and make no attempt to clean them. These rhea ribbons command a much lower price than the Chinese cleaned strips. Our decorticator cleans the ribbons similarly, but leaves them in a more perfect condition than those produced by Chinese hand labour, removing considerably more of the pectose in its fluid state.

"*Preparation.*—The next difficulty is dressing the fibre ready for the spinner. Hitherto the expensive process of preparing on silk dressing machinery has stood in the way; and when we can turn out an article absolutely without waste beyond the shorts or knoils which exist in the fibre, at a cost of one-halfpenny, which hitherto has cost 9d., we can claim success and considerable advance.

"*Spinning.*—This is now a simple process. Our wet spinning frames produce an even yarn, gasing is no longer necessary, and the strength and lustre of the fibre is materially advanced by its abolition.

"*Market.*—On account of its great strength and lustre it is especially in demand for making up into lace, duck, khaki, sailcloth, fishing-lines, braiding, tapestry, and all articles where special strength or lustre is of advantage. It mixes with and fortifies weak wools.

"As the price of the material is lessened, so in proportion will the demand increase."

Mr. Edwards-Radclyffe adds that he will be pleased to forward specimens of the various fabrics, etc. As the fibre does not rot in water, and is exceedingly light and durable, it is becoming the fashionable material for yacht sails and cordage, as well as for fishing-nets and heavy rigging.

There can be no question at all as to the future of ramie fibre; but as Mr. Jackson, manager of the Wollongbar Farm, pointed out in his article in the *Gazette* some months ago, considerable patient and careful experimentation is necessary in order to determine whether farmers in this Colony can profitably undertake the culture of it. He is, meanwhile, doing everything he can to test the commercial possibilities of the undertaking, and in order to secure returns from a wide variety of soils and conditions, has distributed some thousands of roots to farmers in different districts for trial.

The Improvement of Butter for Export.

On the recommendation of the Dairy Expert, Mr. M. A. O'Callaghan, the following circular has been addressed to agricultural societies in all the chief dairying centres :—

By the system under which prizes are now given for butter at shows, it frequently happens that no one gains much benefit beyond the one exhibitor who gets the money; the educative part is overlooked. The prosperity of our dairy industry depends on our success in developing a profitable export trade in dairy products, for unless a market can be maintained outside the Colony, half the people now engaged in dairying would have to give it up. Hence, then, in offering prizes for butter, efforts should be mainly directed towards the guidance of the industry from an exporter's point of view, especially when it is borne in mind that if the butter is good enough to please English consumers it will assuredly please local consumers. The "soon ripe, soon rotten" butter we hear of being specially put up for local consumption should, therefore, have no place in our industry.

If we are to discover and make known the butter that will do for exporting, we must conduct our shows on similar lines to the recent State Butter Show. Then every competitor will know his exact place as a maker of butter calculated to further the industry. I would therefore suggest that all agricultural societies in the chief dairying centres be asked to consider the following suggestions :—

(*a*) Wherever prizes are offered for butter, at least one class should be devoted to butter suitable for export and packed in 56-lb. boxes. The amount of money devoted to this class should be at least equal to that devoted to "local-consumption" classes.

(*b*) All butter for export should be subject to the following conditions :—

1. That the butter be placed in cold store for a period of not less than six weeks—eight weeks being preferable—before judgment is given.
2. That the exhibits be examined before being put away in cold store, and points awarded, and that the exhibits be again examined on the last day of the cold-store interval, and points then awarded; the prizes to go to the exhibits obtaining the highest number of points on the second examination.
3. That the points obtained by each exhibit for flavour on first and last examination be furnished to this Department and to each exhibitor.
4. That the judges be given a book containing only the numbers by which each exhibit is known, that they make their awards on these numbers, and that none, save the secretary or someone appointed by the society, have recourse to the book containing the names which these numbers represent.
5. That all distinguishing marks be effaced from the packages before same are placed before the judges.

That the judges give their opinions as to cause of deterioration.

Mr. O'Callaghan also suggests that to guide the judges in forming their opinions as to the cause or causes of deterioration, a sample of the butters might be sent to this Department for chemical and bacteriological examination. It would, however, be understood that the Department reserves the right not to carry out such examinations should its officers be at any time too busy.

In cases where suitable cold storages is not available locally, the societies could make use of the Government cold stores by paying the ordinary rate of storage. In such cases the butters could be forwarded to Sydney and judged there, and then returned to the local society with the number of marks allotted each exhibit in time to be on show during the exhibition. Good judges are easily obtainable in Sydney, and this system would ensure sound judgment.

The following scale of points adopted by the judges at the recent State show might be used:—

Flavour (including taste and smell)	50
Texture	25
Colour and general appearance...	15
Salting	5
Packing	5
Total	100

Mr. O'Callaghan draws attention to the importance of having prizes given for cream suitable for making butter for export at all agricultural societies' shows in dairy districts, and adduces the following reasons why competition in this direction should be encouraged:—

Good butter cannot be made from bad cream.

Much inferior butter is now being made, owing to the fact that the cream is over-ripe and tainted before it reaches the central factory. This is especially the case with cream from private separators, which is sent in at irregular intervals.

A great many people are now separating cream, and they require educating up to what the central factory requires in order to make good butter.

There should be at least six entries of cream to the one of butter, owing to the proportion of separating stations to butter factories, and hence a greater number will be catered for and educated by these competitions.

Ten gallons of cream in an ordinary can would suffice for one exhibit, and the managers of central factories should be able to judge.

The Minister, in remitting the suggestions of the Dairy Expert for the consideration of the societies, does not desire to lay down any hard and fast rule as to what should be done in these matters, but merely to invite their consideration of the proposals, which, it is thought, may be of advantage to an industry so important to the Colony as a whole. It is gratifying to note that the Agricultural Societies interested have lost no time in considering these suggestions, and already several of the most important of them have signified their intention of adopting the proposals.

EXPORT OF FRUIT TO NEW ZEALAND.

IT will be remembered that in December, 1897, the New Zealand Government, under the provisions of the Orchard and Garden Pests Act of 1896, issued a proclamation prohibiting the introduction into that Colony of any citrus fruit infested with scale. Subsequent to that proclamation, and after the enactment of our own measure to regulate the introduction of diseased fruit into New South Wales, a series of experiments demonstrated that the scale on citrus fruit could be absolutely destroyed, without risk of injury to persons eating the fruit, by fumigation with hydrocyanic acid gas, and consequently, fruit for shipment to Victoria and other colonies was treated under the supervision of the Department, and admitted to those colonies upon production of the Department's certificate. The New Zealand authorities, however, did not see their way to accept such certificates, but suggested that scale-infested citrus fruits might be thoroughly cleansed of the pest by scrubbing before shipment, and would accordingly not come within the operations of the Orchard and Garden Pests Act regulations. Prominent Sydney shippers, to whose attention this communication was directed, pointed out that citrus fruits, from August to December, will not stand brushing, as the process to be really effective causes the skin to break, and the fruit will not keep forty-eight hours, which of course would render it impracticable to ship, unless, as in the case of fruit received in New Zealand from the Islands, the scrubbing could be done under proper supervision upon arrival of the fruit in that colony.

In compliance with further representations made by the Right Hon. the Premier, the New Zealand Government are prepared to relax the regulations so as to admit consignments of fruit covered by certificates issued by the Department of Agriculture of New South Wales, provided also that the cases bear a Government stamp showing that they are really those treated. And further, instead of insisting on the return of scale-infested fruit which may be condemned, the New Zealand Department will fumigate it, charging, however, a somewhat high rate which they do not contemplate decreasing. Properly equipped fumigating houses are now being built at each of the chief ports, viz., Auckland, Wellington, Christchurch, and Dunedin, and as soon as they are ready a fresh regulation will be issued. The Hon. the Premier of New Zealand adds that fruit imported from the Islands is cleaned under the supervision of the Government at the expense of the shippers, because in has been found impossible to get the Island Natives to understand the necessity for such precautions.

Replies to Correspondents.

Teosinte for Ensilage.

Mr. A. A. Loder, of Daranbah, Tweed River, writes:—"I intend making a large ensilage stack of teosinte. Can you let me have full particulars as to feeding value, and whether it is advisable for me to use it for ensilage?"

Mr. Valder reports that teosinte can be made into ensilage just as easily as maize. In feeding-value he does not consider teosinte quite equal to maize, but about the same value for dairy purposes as sorghum. Mr. Jackson, manager of the Wollongbar Farm, speaks very highly of teosinte for ensilage. He finds that for the North Coast district it is, both on account of its feeding-value and great luxuriance, well worth attention.

Of course for ensilage it is hard to beat maize put up just as the cobs reach the glaze stage. The fodder is then at its very best. Mr. Loder also mentions that he made a stack of sorghum silage last year and experienced difficulty in cutting it out. Mr. Valder says the knife in use at the college for this purpose is one called the "Yankee," which he obtained at Messrs. Lassetter and Co's., Sydney.

Nut-grass.

In answer to Mr. Donald McKay, of Brushgrove, Clarence River, who asks for advice as to the best way to get rid of nut-grass, Mr. Geo. Valder, Principal of the H. A. College, says: "Should the nut-grass have obtained a strong hold it is almost impossible to eradicate it. The best means of keeping the pest in check are, first, to immediately remove any nut-grass plants as soon as they appear; secondly, to grow strong crops, such as maize, sorghum, etc., in drills and alternate well between the drills; or, thirdly, to grow crops, such as cow-peas, in drills, cultivate well, and when the food begins to form turn pigs into the paddock and keep them there until they have eaten off the crop and well rooted up the nut-grass."

Bracken Ferns.

Mr. R. T. Baker, Curator of the Technological Museum, Sydney, writes:—In your August issue one of your correspondents, Mr. C. A. Sproull, of Kurrajong Heights, asks the question as to the most effective means of getting rid of the Bracken Fern *(Pteris aqualina Linn.)* For the information of your readers you might perhaps venture to offer the following hint for coping with the Bracken Fern difficulty.

The so-called "root" of the bracken is in reality an underground stem, or rhizome, the same part which in the tree fern is regarded as the trunk. Within this stem, underground or above ground, there is stored each year a supply of starch and other food-plant. Each year's fronds contribute to the supply. The young opening fronds draw upon this vegetable "banking" account until they are fully developed, and then they repay the parent by contributing towards the stored up supply in the stem. It is evident, therefore, that if the young, half-coiled fronds of the bracken are cut down just at the time when they are developing, and when they have been abstracting the nourishment from the stem, the latter will be impoverished, and if they are cut down year by year, the stems must wither and die. They will be quite bankrupt in short, for the mown ferns will have consumed all the available capital. This may seem a rather tedious process, but in a few years it will prove an effective one. There is a splendid description with illustrations in Sach's Text-book of Botany, p. 430, of the development of the leaf of the Bracken.

The immunity of this fern from insect pests is owing to the presence of tannin in it.

Crop Returns.

Mr. T. Arkinstall, of Kelly's Plains writes:—In the August number of the *Gazette* Mr. Hamel asks how is it that we cannot grow the crops in this district now that we did years ago? I could give a dozen reasons, but will confine myself to half that number.

1st. Thirty years ago most of the land here was new, or nearly so, and one cannot expect the very best land to grow wheat and other grain crops for thirty years without impoverishing the land. This is the principal reason.

2nd. Thirty years ago it was as hard to find a bad sample of wheat as it is now to find a good one. Crops then were cut by hand, and good samples were thrashed separately for seed, and could be kept clean and free from trash, consequently most of the seed used was good.

3rd. In the old days, most farms being new were also clean. Wheat could then be sown a bushel per acre or less without fear of being choked with weeds. Plants then had room to grow; but now they have to put on 1½ to 2 bushels to smother weeds and to thicken it up in case of having to cut it for hay. This crowds the plants too much, and produces inferior grain.

4th. In the early days all the ploughing was done by bullocks, and no wheels on the ploughs, which rooted up the soil instead of scratching it, as they do now with their double furrows and four horses about 3 inches deep.

5th. Thirty years ago, all crops being cut by hand, little or no grain was lost in reaping, but the loss with the present binders is very great. I will give an instance. Two years ago I had a small patch of wheat, 5 acres, on black soil, we cut 4½ acres one afternoon, and then it rained for three weeks, the ground then was too wet to get on, and the wheat, ½ acre only, too ripe to handle, so we cut the heads off and put in chaff bags and when thrashing put it through by itself for seed and got five

bags, the other $4\frac{1}{2}$ acres only produced 65 bushels, and there was enough seed on the ground to sow it twice over, but of course we can't go back to hand reaping.

6th. Thirty years ago crops could be sown later without fear of rust, and had better weather for growing if the season was moist.

Mr. Hamel says we cannot grow wheat now even on new land and get the crops we used to get. I must differ with him there, under the same conditions we can still grow those big crops, but will have to plough deep, 7 or 8 inches, have clean new land, good plump seed of a good kind, thin sowing and hand reaping, but as most of these are out of the question we will have to do the best we can under more modern conditions. Personally, I do not believe in wheat-growing in this part; we can't compete with the plains, but I grew corn last year on black soil up to 80 bushels per acre, and this year I got over 40 bushels per acre from 18 acres with no rain from September to New Year, and then only 1 in. in two days and no more for a month, but I hoed and scarified it all the time. On our heavy soils we must grow crops that will produce the most money per acre.

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan. 11, 12
Lismore A. and I. Society	T. W. Hewitt	„ 18, 19
Gosford A. and H. Association	W. McIntyre	„ 20, 21
Kiama Agricultural Association	J. Somerville	„ 25, 26
Wollongong Agricultural Association	J. A. Beatson	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery	„ 7, 8
Manning River A. and H. Association	W. Plummer	„ 9, 10
Liverpool Agricultural Society	J. E. Wilson and G. L. Sutton, Hon. Secs.	„ 9, 10, 11
Berrigan Autumn Show	R. Drummond	„ 15
Ulladulla A. and H. Association	C. A. Cork	„ 15, 16
Lithgow A. H. and P. Society	M. Asher	„ 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society	E. H. Sargent	„ 17, 18
Tumut A. and P. Association	M. McNamara	„ 22, 23
Alstonville A. Society	N. R. Elvery	„ 22, 23
Port Macquarie and Hastings A. and H. Society	J. Y. Butler	„ 23, 24
Bega A., P., and I. Society	John Underhill	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes)	John Priest	„ 1, 2
Robertson Agricultural and Horticultural Society	R. G. Ferguson	„ 2, 3
Upper Murray (Tumbarumba) P. and A. Society	W. Willans	„ 7, 8
Tenterfield Intercolonial P., A., and M. Society	T. W. Hoskin	„ 7, 8, 9, 10
Cudal A. and P. Society	C. Schramme	„ 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood	„ 8, 9
Oberon A. H. and P. Association	Alfred Gale	„ 9, 10
Berrima District (Moss Vale) A., H., and I. Society	H. Richardson	„ 9, 10, 11
Castle Hill and District A. and H. Association	F. H. Rogers	„ 10, 11
Cobargo A., P., and H. Society	T. Kennelly	„ 14, 15
Southern New England P. and A. Association (Uralla)	P. M. O'Connor.	„ 14, 15
Inverell P. and A. Association	John McGregor	„ 15, 16, 17
Nepean District (Penrith) A., H., and I. Society	E. K. Waldron	„ 16, 17
Gundagai P. and A. Society	A. Elworthy	„ 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	„ 16, 17
Candelo Agricultural Association	C. H. Brooks	„ 16, 17
Cumnock P. A. and H. Association	W. L. Ross	„ 17, 18
Walcha P. and A. Association	F. Townshend	„ 21, 22
Blayney A. and P. Association	H. Woolley	„ 22, 23
Upper Hunter (Muswellbrook) Agricultural Society	J. C. Luscombe	„ 22, 23, 24
Camden A., H., and I. Society	C. A. Thompson	„ 22, 23, 24
Bangalow A. and I. Society	John R. Wilson	„ 23, 24
Crookwell P. and A. Association	M. P. Levy	„ 23, 24
Warialda P. and A. Association	W. B. Geddes	April 5, 6
Gulgong A. and P. Association	C. E. Wilton	„ 7, 8
Mudgee Agricultural Society	J. M. Cox	„ 11, 12, 13
Cooma P. and A. Association	C. J. Walmsley	„ 12, 13
Clarence P. and A. Association	Jas. C. Wilcox	„ 13, 14
Lower Clarence Agricultural Society (Maclean)	G. Davis	„ 18, 19
Richmond River (Casino) A., H., and P. Society	Jas. Tandy	„ 19, 20
Hunter River A. and H. Association	W. C. Quinton	„ 19, 20, 21
Orange A. and P. Association	W. Tanner, jun.	April 26, 27, 28
Wellington P. and A. Society	R. Porter	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	....	„ 4, 5
Coonamble P. and A. Association	F. C. Lamotte	„ 10, 11
Dubbo P. A. and H. Association	H. Munckton	„ 9, 10
Hawkesbury District A. Association (Richmond)	C. S. Guest	„ 11, 12, 13*
Mudgee Agricultural Society	J. M. Cox	„ 16, 17
Walgett P. and A. Association	Thos. Clarke	„ 17, 18

Society.	Secretary.	Date.
Durham A. and H. Association	C. E. Grant ...	May 17, 18
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20
Moree P. and A. Society	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Association	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association	N. A. Read ...	,, 1, 2
Parkes A. and H. Association	J. H. Lane ..	,, 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Society	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
Moree P. and A. Society	S. L. Cohen	,, 30, 31 September 1
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Moama A. and P. Association	C. L. Blair ...	,, 13
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Germanton P. A. and H. Society	G. T. S. Wilson	,, 20, 21
Yass P. and A. Association...	W. Jermyn ...	,, 21, 22
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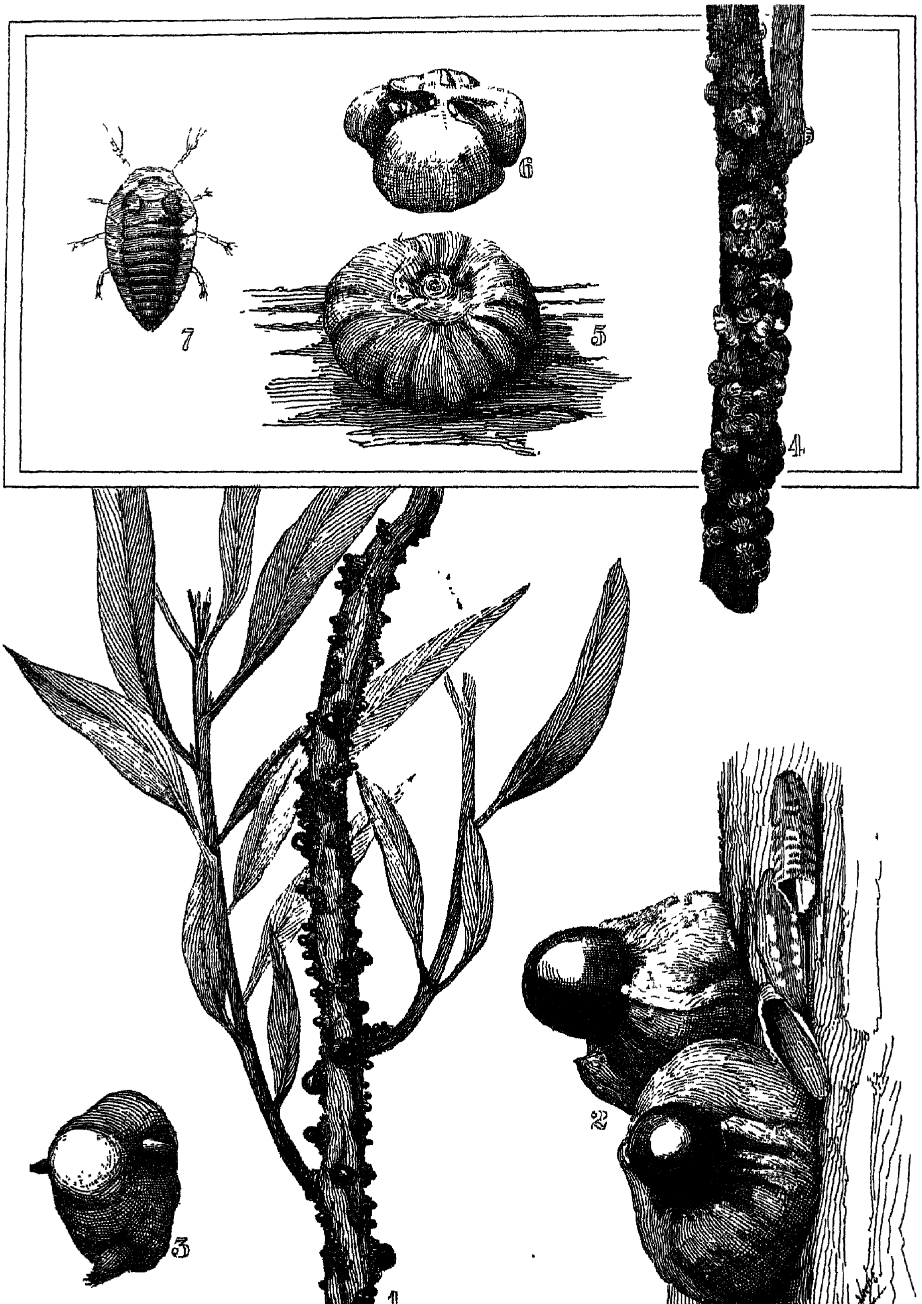
* Entries close 20th April.

[12 plates.]

Sydney: William Applegate Gullick, Government Printer.—1899.



AUSTRALIAN LAC INSECTS.

1 Tachardia australis, N. Sp., upon the food plant.
2 Adult male and female insects enclosed in the tests
3. Adult female taken out of test.
4 Tachardia decorella musk upon the food plant.
5. Adult female test enclosing insect.
6. Adult female taken out of the test.
7. Larva.

Scale Insects that Produce Lac.

With a Description of a New Australian Species.

By WALTER W. FROGGATT.

There are, probably, scores of people who are constantly using shellac, or who have often admired the beautifully varnished cabinets and boxes imported from India and China, who have not the least idea from whence or how shellac is obtained; and they would hardly credit the fact that it is produced by a tiny little coccid closely allied to some of our most injurious insect pests. This, however, is the case, and it is owing to the countless millions of these tiny creatures sticking their sharp bills into the bark, and discharging the waste sap they cannot eat in the form of a sticky secretion, in which they ultimately become embedded, that shellac is produced. The chief home of the lac insects of commerce is in the great forests of India, Burmah, and Assam, though the same species are also found in Ceylon, Siam, China, and some of the islands of the Eastern Archipelago. It is found most abundantly in Bengal, but the best qualities come from Assam and Burmah, though the quantity and prices vary considerably. About 25,000 tons of lac are collected every season in the central provinces of India, and the annual value of the lac crop some years ago was estimated at over a quarter of a million sterling. An immense number of natives are engaged during the season collecting lac, and they pay a heavy royalty to the Government for the privilege. It is a remarkable fact that lac is produced from the sap of at least sixty different kinds of forest trees, so that the material is a true insect product, the sap having undergone some chemical change in passing through the insect. The little creatures, when first hatched out as minute larvæ, act in the same manner as those of all scale insects, crawling along the branch or twig until they find a suitable place to commence operations, when they stick their sharp-pointed mouth (rostrum) through the bark and suck up the juice; part of this they convert into food, expelling the rest in the form of a fine fluid, which hardens into a sticky, viscid substance when exposed to the air and sun. As this is deposited all round it by a couple of curious arm-like projections on either side of the insect, which are known as "lac tubes," the creature soon becomes imbedded in the secretion, and the accumulations of the adjoining insects run together, and completely encrust the twigs and

branches, with nothing to show that there is an insect beneath, except a small hole at the apex, through which the young freshly-hatched larvæ crawl to start a fresh crop of lac.

The male larvæ produce only a small, elongated, roughened-ridged cell or test of lac, from which they emerge as dainty little two-winged flies; the female, on the other hand, having no use for legs or antennæ, loses her larval appendage, and becomes a rounded top-shaped creature with no means of locomotion, and quite unlike her mate, though when first hatched out from the egg as tiny little larvæ one could hardly tell the difference of the sexes.

The different kinds of lac are known in commerce under many names. Stick lac is the natural production encrusting the twigs just as it is obtained from the forest; seed lac is the stick lac after it has been ground up in water to extract the colouring matter out of the insect known as lac dye; button and shell lac are prepared from the seed lac by melting the latter. Other forms, such as garnet and liver lac, are produced from different qualities of shellac, the colour often differing considerably in the various districts, while some of the fine bright orange shellac is said to be artificially coloured with orpiment. Lac is extensively used for making the finer kinds of sealing-wax, and is the chief ingredient in most of the wood polishes, besides the regular lacquer varnish used to coat the boxes, cabinets, and toys known as lacquer ware used so much in China and India. The lacquer ware from Japan, however, is polished with a varnish made from the sap of one of the sumach trees (*Rhus venix*), and not from insect lac.

Lac dye is extracted by grinding up the stick lac containing the dead insects and soaking them for some hours; the mixture is then well stirred up, the coloured water allowed to settle, and after several washings and boilings the dye is deposited as a sediment at the bottom of the pans, from which it is dug, pressed, and stamped into cakes.

The old entomologists described the lac insects under the names of *Coccus lacca*, but when Signoret classified the family he placed this group under the genus *Carteria*, defining them under the following peculiarities :—Coccids in the adult female form without legs or antennæ, a turbinate body ending in an abdominal tail, fringed with hairs; two processes on the sides of the body known as "lac tubes," through which the secretion is deposited, and a curious abdominal spine.

In a later paper on Coccids (1886), Signoret said that he had discovered that the generic name Carteria had been pre-occupied some years before by a group of mollusca, and proposed the name *Tachardia* to take its place, so that now all the lac insects are grouped under this name.

The members of this group have, as has been before noted, a wide range over the eastern parts of Asia, from whence two species are recorded, *Tachardia lacca*, Kerr, and *T. ficus*, Fab. Comstock has described two curious species—the first, *Tachardia mexicana*, found upon an acacia (*Acacia Greggi*) growing in the desert country of Mexico, where it produces a considerable amount of lac; and a second one, *Tachardia larrea*, found upon a small shrub known as the "stink weed," or "creosote bush," that grows plentifully in the dry portions

of Colorado and Western Texas. This lac is said to be very plentiful, and is used by the natives to make into balls for games.

Cockerell has since described four more American species: *Tachardia gemmifera; T. pustulata; T. fulgens;* and *T. cornuta,* none of which seem to be as common as the former species. In Australia we have three well-known species, all found in poor, dry country, with the exception of *T. decorella,* common about Sydney, to which I add in this paper another new species; thus, up to the present, only twelve species of lac insects are recorded.

It is not at all probable that lac would ever pay to cultivate in the dry western country of Australia, as the method of gathering it would be too expensive; but from specimens that the writer has seen in the bush, if it were worth cultivating it would spread very rapidly if carried about and propagated from tree to tree as is done by the natives of India, and I believe that some of our native lac insects produce a very good shellac.

Tachardia australis, n. sp.

General colour of adult female bright, red, smooth, and shining when first melted out of the lac in chloroform, but showing a somewhat laminated or shagreened appearance when washed in alcohol. Boiled in potash, it gives out a deep purple colour. Length, 1½ lines.

Form turbinate, elongate, the cephalic fold falling over in front and rounded as in some of the Brachyscelids; vertex rounded; dorsal surface smooth, rounded to abdominal tail, which generally curves backwards; tail short, broad, peg-shaped, apparently three-jointed, with the anal tail or tubercle fringed with a ring of somewhat fan-shaped, stout, spiny hairs, nine to ten in number, and covered with fine lobules.

On the ventral surface, rostrum, long, slender pointed, lac-tubes standing like a pair of arms, very long in comparison with other Australian species, constricted slightly above the base, swelling out above the base, enlarged again in the centre, but tapering to the tip, which is roughened and irregular in form. When treated with potash these show an inverted funnel-like cavity, tapering from the apex, and coming to a point before the junction with the body, fringed along the sides with fine lobes. Spine above the abdominal tail; standing out long and slender below this spine, but not in a line with it, are two short, thorn-like tubercles. These might be taken for the remains of aborted legs, but show no structure; no legs or antennæ showing.

♀ (female) test formed of a rough, reddish-brown mass of lac, from the apex of which springs out a bright, shining, blackish-brown globule of lac, looking as if it had bubbled out from below; when immature, each one stands out separately, but as they increase in size at the base they run together and form a regular mass at the base, with the bubbles marking each individual coccid, showing no opening in the cell above. Height of ♀ test, 2 lines; diameter of basal portion, 2½ lines.

♂ (male) test, 1 line in length; long, slender, and transversely ridged or corrugated along the dorsal surface. These ridges are more numerous than on the male tests of *T. decorella;* the apical opening truncated, and covered with a flat lid.

This coccid was covering the stems of a number of small shrubs (*Beyeria viscosa*), many of which were killed by their attacks.

Tachardia decorella, *Maskell.*

[Trans. N. Zealand Institute, vol. xxv, 1892.]

This is our typical Australian form, and is not uncommon in the scrubs about Sydney, and northward up the coast. I have found it upon *Eugenia Smithii* and *Leucopogon microphyllus,* near Manly; upon *Monotoca elliptica,* at Rose Bay and Cook's River; and in Maskell's Catalogue it is recorded upon the last-named shrub, and *Myrica cerifera,* in New South Wales, and as not uncommon in the mallee country of Victoria on several "native plants." Maskell received specimens of this lac insect from the Superintendent of the Indian Museum in 1895, obtained in India, attacking tea and forest trees; so that it has a very extended range.

The full grown test is a very pretty object, but variable both in size, colour, and shape, on different shrubs, from $\frac{1}{6}$ to $\frac{1}{8}$ of an inch in diameter, but when thickly covering the food-plant they run into each other, forming regular masses; so that it would be difficult to decide upon its natural form.

The adult female is covered by a flattened corrugated test of brownish-yellow resin; the original larval test forming a centre from which the later accumulations of resin radiate in regular ridges, forming a regular circular mass, flattened on the top, and ribbed right round; at the hind extremity of the larval test is a minute opening, and on the under surface, when the mass is removed, only the centre is found open, so that the insect is enclosed in an almost solid mass. The insect is dark red, of the usual globular form, with a prolongation of the abdomen into a sub-cylindrical tail; it shows no signs of legs or antennae, but the lac-tubes stand out on either side like an abbreviated pair of arms. The curious spine is present upon the abdomen, and the tip of the abdomen is fringed with fine hairs.

The male test remains like the central larval test of the female on a larger scale, elongate, ridged, and ribbed on either side with a lid-like opening at one end.

Tachardia melaleucæ, *Maskell.*

[Trans. N. Zealand Institute, vol. xxiv, 1891.]

This species has been recorded from Victoria upon *Melaleuca uncincta* and an undetermined species of eucalyptus, and from South Australia upon *Melaleuca pustulata* and *Astera axillaris,* but there is no record of it from this Colony. Maskell says that it is closely allied to *Tachardia mexicana.*

"They produce a quantity of very dark red or purple resinous matter, which may be aggregated together in masses on the twig, or in detached semi-globular pieces, each of which contains an insect; on the outside of these resinous masses may be frequently seen small quantities of white cottony fibres." Maskell, further on, says "that on various parts of the cephalic region are little groups of sub-cylindrical tubes; probably from all of these are produced these cottony fibres. The adult female is much larger than the former species, of a similar dark red, globular form; the larvæ are small, red, active insects, about $\frac{1}{50}$ of an inch in length, flattened on the back, with the tip of the abdomen divided into two divergent anal tubercles."

Tachardia acaciæ, *Maskell.*

[Trans. N. Zealand Institute, vol. xxiv, 1891].

This species was obtained by the collectors on the Elder Exploring Expedition in Central Australia upon an undetermined species of acacia. "The insects excreting a quantity of light red or pinkish resinous matter, aggregated in masses or in detached irregular pieces." The adult female is of the usual globular form, but the extremity is very much less hairy; the lac tubes are shorter than in *T. melaleucæ*. The tip of the abdomen divided, each bearing two spines.

Treatment for San Jose Scale.

Mr. A. Wilkinson, of Murruba, Berowra, writes:—

In November, 1897, I had some young apple-trees looking very sickly, and seeming to me to have some scale on them I did not know. I cut off some twigs, and took them to the Department's Entomologist. The following week Mr. Froggatt paid me a visit and told me they were badly infected with San Jose scale, recommending me to have them dug up and burnt. They had been two years planted from the nursery where I bought them. I thought I would experiment with them. The first two I painted with a small painter's brush from tips to root with kerosene direct from the tin, covering all the trees except the foliage—I felt surely I had killed the trees; the remaining trees I painted with the paste of soda and soap I was using for the woolly aphis. This I found to be effectual, doing no apparent damage to the bark of the tree, as I thought the kerosene had done. Last year I again painted them, although I could see nothing of the scale. I have just now looked over carefully the whole of my apple-trees, and cannot find the least suspicion of a trace either of San Jose scale or American Blight, and find the condemned trees to have made fair growth for the very dry season and look healthy.

Useful Australian Plants.

By J. H. MAIDEN,
Government Botanist and Director of the Botanic Gardens.

No. 53.—*Agrostis Muelleri*, Benth.

Botanical name.—*Agrostis*—a Greek word signifying grasses in general—a derivative of *agros*, a field; hence the word "Agrostology," the science of grasses. *Muelleri*, after Baron von Mueller.

Synonyms.—*A. canina*, Linn., var. *gelida*; *A. gelida*, F.v.M.

Vernacular name.—Mueller's Bent Grass.

Where figured.—Buchanan's *Grasses of New Zealand*, as *A. canina*, Linn; var. *gelida*.

Botanical description (B. Fl. vii, 576).—A densely tufted grass, 2 to 6 inches high.

Leaves very narrow.
Panicle narrow, though rather loose, 1 to 1½ inch long, with short, erect, capillary branches.
Spikelets purplish.
Outer glumes very pointed, about 1¼ line long, glabrous, or the keel minutely ciliate.
*Flowering glume** much shorter, thin and hyaline, obtuse, enveloping the flower and grain, without any (or a minute and rudimentary?) palea.
Stamens, three.

Value as a fodder.—A valuable pasture grass for cold regions.

Habitat and range.—An Alpine species, confined to the Alps of New South Wales and Victoria. We have it from the highest parts of Mount Kosciusko (*see Gazette* for October, page 1019). This grass is also found on high mountains in New Zealand.

REFERENCE TO PLATE.

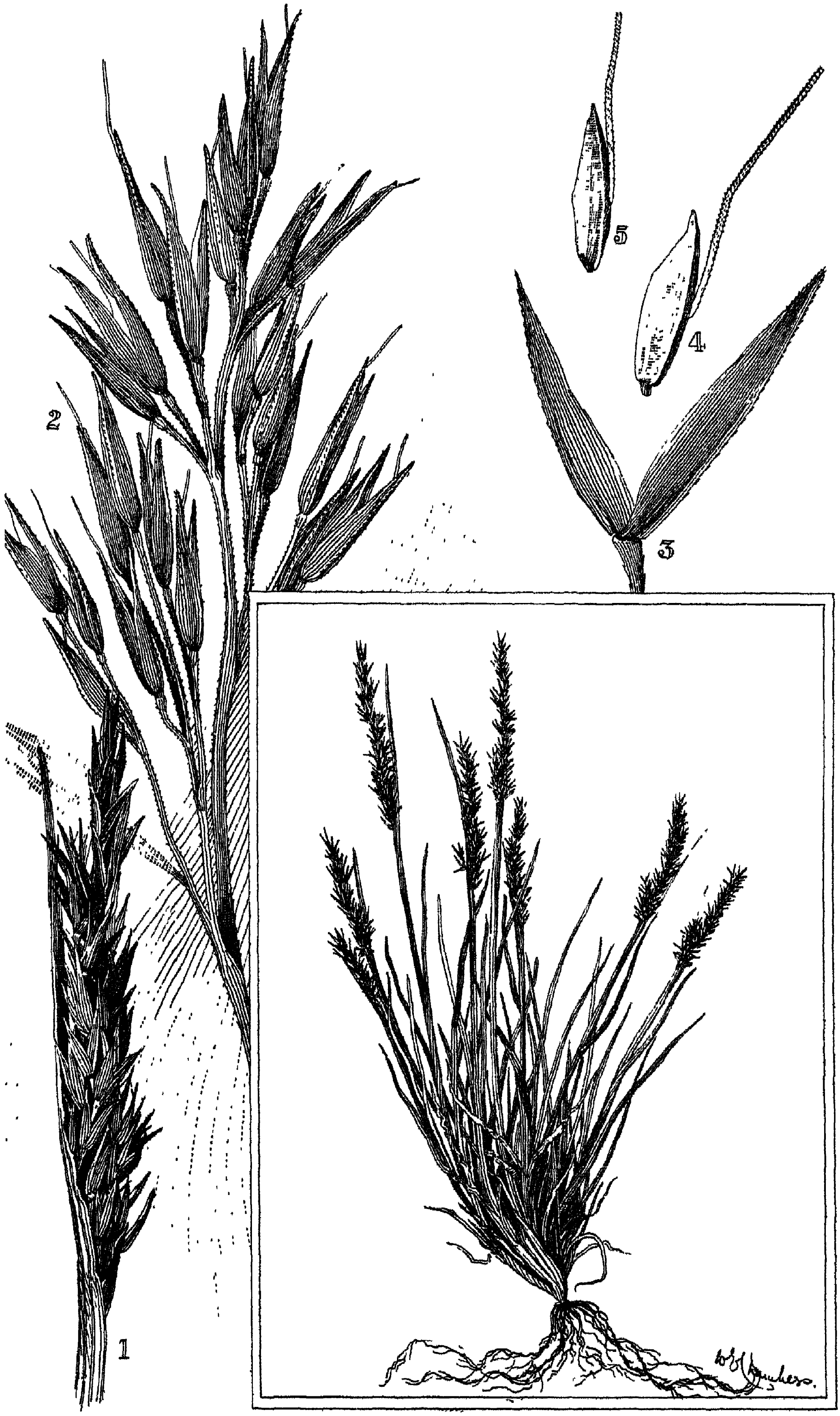
N.B.—This plate will be found in the *Agricultural Gazette* for August, where it was inadvertently labelled *Paspalum compressum*.

Plant natural size.

1. Portion and unexpanded panicle.
2. Expanded panicle.
3. Outer glumes.
4, 5. Fruiting glume, showing attachment of awn.

N.B.—The typical *A. Muelleri* has no awn, but all stages and awns occur on plants found on Mount Kosciusko.

* In this species the awn may be absent or present. See a note under "Reference to Plate."



AGROSTIS MUELLERI, Benth.

No. 54.—*Agrostis scabra*, Willd.

Botanical name.—*Scabra*, Latin, rough, the grass being somewhat harsh.

Synonym.—*A. parviflora*, R. Br.

Vernacular names.—The "Slender Bent-grass" of Buchanan; the "Plain Grass" of the United States; other American names are "Rough Bent," "Flyaway Grass" (because the delicate particles, when mature, break away from the stalk, and are blown away by the wind), "Tickle Grass," "Fool Hay," "Silk Grass."

Where figured.—Hooker (*Flora of Tasmania*), Buchanan (*New Zealand Grasses*), as A. *parviflora*, Gray's *Manual of Botany* (American), pl. 7, fig. 3.

Botanical description.—

Stems slender, tufted, 6 inches to above 1 foot high.

Leaves very narrow, almost filiform in the typical form, chiefly at the base of the stem.

Panicle compound; very loose and slender, with spreading capillary branches.

Outer glumes narrow, keeled, rather acute, about ⅔ line long.

Flowering glume shorter by a line, broad, and enveloping the flower, obtuse, truncate or slightly jagged, unawned.

Palea, none (or very minute ?).

Stamens, three.

Var., *elatior*, Benth.; taller, leaves flatter and flaccid, panicle very loose and spreading.

Southern mountain ranges and New England; also in Victoria.

This species is variable as regards the awn on the flowering glume. Hooker's figure shows a rudimentary awn; Buchanan's figure shows no awn; my specimens (*see* plate) show no awn. The unreliability of the awn, as an absolute character in certain species of *Agrostis*, is dwelt upon in the *Gazette* for October, page 1019.

Value as a fodder.—Produces a neat turf, which has been reported by some writers to be valuable for fodder. The judicious Bacchus, whose writings on Australian grasses form the basis of much that has since been written on the subject, says of the normal species: "Perennial, about 18 inches high, vegetates rather late, making small patches of close turf." Of the variety *elatior*, he says: "This grass is not so much eaten by stock as I had expected from its inviting appearance."

Buchanan also speaks of it as a valuable grass.

In the *Colorado Agricultural Bulletin*, No. 12 ("Some Colorado Grasses"), this grass is alluded to as "this worthless species, abundant in wet meadows at all elevations." Lamson-Scribner states that it possesses little or no agricultural value. These statements carry the greater weight, since the species is widely distributed in the United States. I do not know to what extent these conflicting opinions are capable of reconciliation; certain it is that there have always been

differences of opinion as to the fodder value of some species of *Agrostis*, and it is hoped that the matter will be inquired into in regard to plants whose botanical origin is open to no doubt. The matter is discussed by Buchanan under *A. parviflora*.

Other uses.—"Before the panicle has expanded, the grass is sometimes gathered and sold, under the name of 'silk-grass,' for dry bouquets." (Lamson-Scribner.)

Habitat and range.—Found in all the colonies except Western Australia. In New South Wales, found on the southern mountain ranges and high tablelands south and north. We have it from Pretty Point (Mt. Koscuisko), 5,500 feet; also from the Guy Fawkes country, New England. A grass of cold localities exclusively. (*See Agricultural Gazette* for October, page 1018.)

REFERENCE TO PLATE:

1. Grass, natural size.
2. Portion of a compound panicle, showing the spreading branches.
3. Outer glumes.
4. Flowering glumes (unawned).

USES OF THE EUCALYPTI.

MR. L. F. WOOLRYCH, of Cooma, writes:—

IT has struck me that a few notes on some of the uses to which different parts of the various eucalyptus trees are put would be of interest. The eucalyptus family is truly to the Australian what the palm is to the Eastern peoples, spread as it is all over the continent and always within reach. In Europe it is a common belief that the trees of our forests throw no shade, but for shade and shelter purposes many of them are invaluable, as well as for their beneficial effect in connection with miasma arising from swampy ground. In New Caledonia the ti-tree (*Melaleuca*) is planted for the latter purpose. Then the young leaves may be used for poultices, or as sticking-plaster, which will only wear off. One variety (*E. obliqua*), called here stringybark, will provide the selector's fence, gates, slabs for house, and bark for the roof, as well as firewood. The fluffy part of the bark is splendid for kindling purposes, and the inner bark makes excellent ropes, ties, and make-shift harness. The bark will also make good pipes for carrying water. The gum is often used as a medicine for sick fowls, and is also a good bush remedy for dysentery, as old bushmen have told me frequently; and it makes a good varnish when dissolved in spirits of wine. The honey from the eucalypti is, if used in quantity, said to be a violent purgative, but if consumed in the ordinary way is a mild aperient. In fact one might go on for a long time before the list of uses to which these valuable trees can be put would be exhausted.

AGROSTIS SCABRA, Willd.

Fig. 1.—First stage of growth.

Fig. 2.—Second stage.

Fig. 3.—Mature tree.

LEOPARD TREE (*Flindersia maculosa*).

Some Western Plants.

Useful, Ornamental, and Curious.

W. S. CAMPBELL.

As considerable attention has been given lately to many of the plants used for fodder during the late disastrous droughts in the western and north-western districts of this Colony, or the country west of the Great Dividing Range, I took the opportunity of a recent visit to the West Bogan Experimental Farm, at Coolabah, to obtain a few photographs of some of these fodder plants, not only as matured trees, but in one or two instances as they appear in their early stages of growth. This remarkable growth has probably been developed for the purpose of a protection from the attacks of herbivorous animals.

It is well known to botanists that numerous species of plants are provided with some means whereby they are saved from destruction by herbivorous animals, either by spines, prickles, poison, or some other peculiarities; and generally speaking this protection continues during the lives of the plants; but some, however, are protected only for a certain period during their early life.

One of the most remarkable instances of this latter provision that I have ever noticed amongst our Australian plants, is that of the Leopard-tree (*Flindersia maculosa*, F.v.M.), one of the most ornamental of western plants when fully matured, or even partly so, but which, during its early stages of growth, is one of the most peculiar and grotesque of plants, spreading over the ground in the shape of a dish-cover, with queer, small, angular, and contorted branches which terminate in blunt sorts of spines; indeed, I suppose they may be considered spines. The leaves are small, ovate, and but few of them, and growing well within the protecting spines.

I am unable to state positively that this contorted spiny growth is natural, and inherited for the purpose of protection; or whether constant nibbling by herbivorous animals causes a deformity, for I have never been able to discover, in the hundreds of young plants I have examined, even the smallest, without the angular branches and spines. However, I am endeavouring to obtain seeds to test this rather interesting question. Perhaps some reader may be able to throw a little light on the subject.

This dish-cover shaped, or hemispherical growth, which is clearly shown on illustration No. 1, continues until the plant attains the height of 4 or 5 feet or so, when a leading shoot grows up into a handsome small tree bearing rather pendulous branches and comparatively long narrow leaves. The stem continues to bear a mass of the original spiny branches, which gives the young tree a most remarkable appearance. (*See* illustration No. 2.)

In course of time the tree as it increases in dimensions gradually casts off its peculiar angular branches and appears as shown in illustration No. 3, with the usual spotted bark from which the name Leopard-tree has been given. Illustration No. 4 shows a branch from a young plant bearing spines and small leaves on the left, and on the right a branch from a matured tree with the long leaves and willowy-like growth.

Other species of plants appear to take advantage of the protection of this tree in its young stage of development, and one in particular I found to be a constant companion, viz., *Pimelia microcephala* R.Br. which grows most comfortably and well protected amongst the spiny branches. This plant develops a long, almost a climbing, stem, so that by the time—if it lives so long—the spiny branches of the Leopard-tree die away, it is high up above the reach of the most common of the herbivorous animals.

The *Citrus australis* Planch., or true native orange, is another tree, or tall-growing shrub, which protects itself from the attacks of herbivorous animals during its early growth, and in a most pronounced manner, by numerous true sharp spines. Its leaves at first are few and small and the branches stout; but when the tree has fully developed the leaves are considerably larger and longer, very numerous, and the branches thin and willowy. Illustration No. 5 shows clearly the two stages of growth. The difference in the appearance of a plant during its various stages of growth is most remarkable. The first is contorted and irregular, and in the last the plant is of a singularly regular shape. I have seen many specimens so regular in outline—oval or circular—that anyone could well imagine them to have been clipped. I was not able to find a good specimen to photograph, but shall probably meet with one on a future journey west.

It seems to me quite possible that some use may be made of our two species of citrus, *C. australis* and the "Finger Lime," which grows in the north-eastern coast districts—*C. australasica*, F.v.M. Recent experiments made in the United States in crossing *C. trifoliata* with other species are being watched with much interest, and it may be that something in the same way might be effected here, and orange-trees of a new type produced which may succeed where the present varieties fail.

The most valuable of our fodder trees seems to be beyond all question that known locally as the "supple-jack," in western districts, or "Cunnyannah" in the north-west, botanically known as *Ventilago viminalis*. Illustration No. 6 shows a typical specimen of a tree in its natural condition, and No. 7 shows one which has been lopped for fodder purposes for no less than five years in succession. This frequent lopping seems to have little or no effect on the supple-jack, which has wonderful recuperative qualities and adaptability for dry districts.

During early growth it is a slender climbing stem, which quickly raises its leaves beyond the reach of herbivorous animals, and supports itself on any kind of tree near which it happens to grow. In course of time its stem, which enfolds the supporting tree, thickens and kills its companion, and it then stands alone, like the coastal varieties of Ficus, whose embraces destroy, in time, their living supports.

Fig. 4.—Showing a branch from a young Leopard Tree bearing spines and small leaves on the left, and on the right a branch from a matured tree with long leaves and willowy-like growth.

Fig. 5.—Showing the stages of growth of *Citrus Australis.*

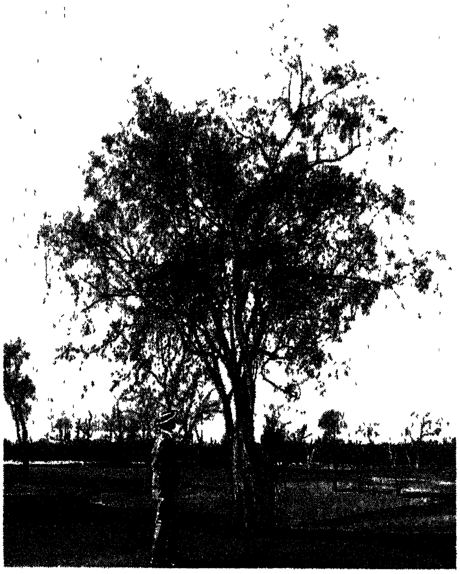


Fig. 6.—Supple-jack (natural condition).

Fig. 7.—Supple-jack (which has been lopped).

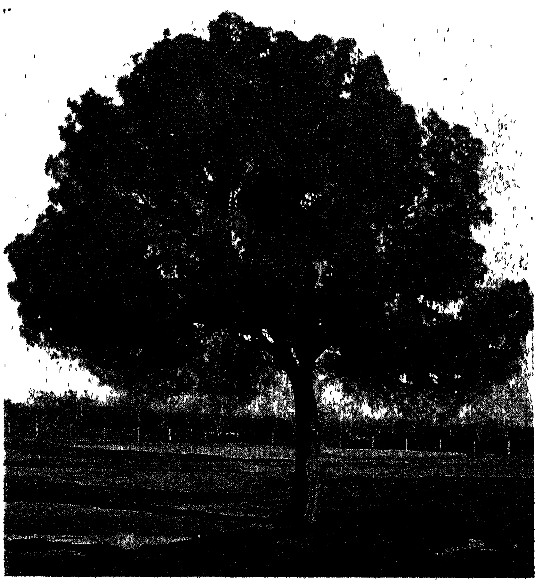


Fig. 8.—Colane (*Owenia acidula*).

Fig. 9.—Showing fruit and leaves of *Owenia acidula*.

Fig. 10.—Leaves and fruit of *Codonocarpus Australis*.

This tree should be most carefully preserved, but, unfortunately, it is not infrequently destroyed by lazy teamsters, who burn down fine specimens to save themselves the trouble of lopping off the branches when requiring fodder for their horses or bullocks.

One of the most handsome of the western low-growing trees is the Colane, known to colonists as *Owenia acidula*, F.v.M., named in honor of Professor Owen. In appearance this tree is somewhat like the "Pepper-tree," *Schinus molle*. Figure 8 shows a fine specimen, which I found growing on a plain by itself. It is useful for fodder; but I doubt whether it is nearly so valuable for that purpose as the former tree. It bears pretty reddish-coloured fruit, of an acid taste; hence the specific name *acidula*. Illustration No. 9 shows fruit and leaves.

Illustration No. 10 shows leaves and fruit of a rather curious shrub known locally as the "Mustard-tree"—and a very suitable name, for the leaves have a remarkably pungent taste very like mustard.

It belongs to the same natural order as the well-known "Ink-weed," which infests all newly cleared land in our northern coast districts, *Phytolacca octandra*, but to this weed it has no resemblance whatever, as may be seen. Its botanical name is *Codonocarpus australis*, A. Cunn., which signifies bell-shaped fruit. It is said to be useful for fodder, but seems to me to be rather scarce, for I have seen only one specimen, although I have travelled thousands of miles in the western country, and could hardly miss noticing such a conspicuous-looking plant with silvery-looking light green leaves.

Several other photographs of useful plants which I took did not turn out to be sufficiently good for illustrations owing to cloudy and hazy weather; but I hope to succeed better next visit, and, if sufficiently good, the photographs will be produced in the *Agricultural Gazette*, with some short notes as above.

TICKS.

DRAWINGS are now being prepared under the direction of the Entomologist, on behalf of the Royal Commission appointed to inquire into Diseases of Stock, to illustrate all the different varieties of ticks—from the common little picnic pest to the dreaded cattle scourge. It is hoped that plates with fullest details will be available for publication in next issue of the *Gazette*.

Economical Feeding of Stock in the West on Purchased Food Stuffs.

R. W. PEACOCK.

DURING the past drought many thousands of sheep and other animals have been fed upon purchased foods, and various opinions obtain respecting the most suitable fodders for such purposes; also, many disappointing results have been obtained by feeding upon many diets which have been recommended without due consideration as to their value. There has been a great lack of practical knowledge, as well as disregard of scientific principles, in the choice of economical rations. It is well known that analyses of various foods do not prove the exact proportions of nutritive qualities contained in any of them, as the processes they are subjected to are not similar to the complicated digestive processes of the stock eating them, and which vary considerably in different classes of animals. But science has added much to the general knowledge we possess regarding general values; and this, aided by careful practical observations, has enabled experimenters to formulate well nigh perfect rations for the sustenance of farm and station stock. Conditions of climate must not be lost sight of, as experiments are rendered of less value when applied to stock under dissimilar conditions. This factor has not been taken sufficiently into consideration during the past drought, and we find stockmen feeding upon rations more adapted for the cooler climates, the results of which have proved very discouraging. Also when food-stuffs are purchased from a distance, railway freights and cartage from the railway should be taken into consideration, and the more concentrated the food, consistent with the requirements of the animal, the cheaper will it be landed at the feeders. Many thousands of pounds have been injudiciously expended in the west during the last six months, owing to imperfect rations being given to the stock. There are many factors to be considered in the choice of an economical food-stuff, such as composition, digestibility, wholesomeness, and price; and it will always be found more profitable to purchase the best qualities of the materials making up the diet. As regards composition, the most essential constituents are albuminoids or proteids, fats, carbohydrates, and ash; and upon the relative amounts of these ingredients depend the value of the fodder, combined, of course, with digestibility, wholesomeness, and flavour. The albuminoids are by far the most important ingredients, as they are in themselves capable of supplying most of the requirements of the animal, and are essential to the production of fresh, and the renovation of old, tissues, and are of paramount importance in the production of wool. The fats are a highly

concentrated food, and are used up in the production of heat and mechanical action; the carbohydrates are also made use of in this way; but neither could take the place of the albuminoids in the animal organism. A quantity of ash is essential; but as it is found in sufficient quantities in most foods, does not require the attention of the former. The principal relations to be considered are those existing between the albuminoids, or flesh formers, and the carbohydrates and fats, or heat producers. The carbohydrates and fats are also capable of being stored up as fats in the animal after the other requirements have been satisfied. The relative proportions of digestible albuminoid and the digestible non-albuminoid substances in a food are termed the "albuminoid ratio," and the exact ratio of an economical food differs widely with the class of animal, and also the uses to which the animal is put. What concerns us principally here is how to maintain the condition of the animal and the production of wool. For mature sheep the proportion or digestible albuminoids should not be lower than one part to ten parts of digestible non-albuminoids, and for many purposes the diet should be richer in nitrogenous material. This percentage approximates the value of the ordinary pastures; a young shoot of grass would be very much richer, and stock would fatten more readily upon it. Taking this, then, as our basis for an ordinary maintenance ration, we will be able to inquire into certain mixtures likely to give the desired result; always taking into consideration the variation in the composition of the bulky foods, owing to the season, character of soil, and modes of curing. We must also confine our attention to the available food-stuffs. Hay well made from the cereals would closely approximate our basis, but the ratio would be materially affected if the crop was allowed to mature too fully before making, as a larger proportion would be rendered indigestible. Hay cut whilst in bloom is much more valuable than that which is often chosen on account of the percentage of grain it contains. With well-cured lucerne hay, cut just as the first blossoms appear, a greater percentage is digestible, and its high percentages of nitrogen and lime peculiarly fit it for young growing animals. Wheaten and oaten straw possess a ratio of about 1 to 13, the oaten straw being preferable to the wheaten, and such foods would prove very expensive as regards their feeding values, when freights are taken into consideration. Bran has a ratio of about 1 to 6, oats about the same, and maize 1 to 10; but as a larger percentage of bran and oats are indigestible, and maize very perfectly and easily digested, the preference must be given to the latter, and as compared with oats, is worth considerably more per bushel, one reason being that there are but 40 lb. to the bushel of oats, which also contain a large proportion of husk, and 56 lb. to the bushel of maize. The current prices in the market seriously affect the demand for these two feed grains, and some judgment is necessary to know when one is cheaper than the other as a food stuff. Taking into consideration the ratios of the ordinary foods, it would always prove economical to mix the chaff with some grain, and also a little bran, very small quantities sufficing in many instances; whereas if straw is used, larger quantities should be given to provide a suitable ration. There is great need of experiments in this direction, and if carried out

systematically would prove of great value. Many pastoralists have been led to try the feeding of sheep upon straw and molasses, and have been very disappointed with the results. The stock appeared to do well for a time and then fell away considerably, the reason being easy of explanation; for, as above stated, straw is of slight value by itself, lacking sufficient nitrogen, the molasses also being practically non-nitrogenous. The sheep would languish in consequence from nitrogen starvation. This food, unless mixed with a fair quantity of grain, cannot be too strongly condemned. In some instances grains alone have been fed to the stock, carrying it to the other extreme, as such a diet would be too concentrated for the stomachs of ruminants, as their digestive organs are particularly adapted for bulky foods. Such feeding must always prove unsatisfactory, and some careful experiments would always pay the owner before attempting to feed upon a large scale. The system of giving whole hay to stock is decidedly wasteful, and it should always be chaffed. In the above I have attempted to set forth principles which may prove useful upon future occasions. The variations of the digestibility and composition of many food-stuffs, and the difference in the classes of animals to which they are fed, forbid the laying down of any exact rule; but I would simply urge the necessity of experimenting as a guide to economical feeding.

Animal Food for Poultry.

A correspondent, in a letter to the Chemist of the Department, asks:—"What amount of protein and fat is contained in the blood and bone manure, dried blood, and nipho mentioned on p. 65 of the *Farmers and Fruit-growers' Guide?* I am using the two former manures to mix in poultry foods, and the fowls thrive well on it. Some time ago, at the New York Agricultural Experiment Station, a series of experiments were conducted to determine the economy of using animal food in poultry-feeding, and it was found that fowls and ducks fed on 'animal meal' gave the best results. I wrote asking if the manures I name above were suitable for poultry foods, and the reply was 'Yes, if fresh.' I now want to know exactly the protein and fats contained in them. Some of the American poultry foods give the following:—

Bowker Fertilizer Co.'s animal meal—

Protein	42·51 per cent.
Fat	12·95 ,,

Bradley's Fertilizer Co.'s meat meal—

Protein	43·56 per cent.
Fat	15·95 ,,

In reply, Mr. F. B. Guthrie states:—"Dried and ground meat contains about 75 per cent. protein and about 9 per cent. fat. This was the composition of a 'beef-flour' examined here, and dried till it contained about 11 per cent. of water. Dried blood should have about this composition, and would be mixed with bran, chaff, molasses, etc., for feeding. It will, however, be necessary to send a sample of the particular substance information is desired about to enable me to determine exactly its feeding value."

[There can be no question that if American scientists and our correspondent have found their fowls to thrive on "manures," the innovation is a good one from a strictly business point of view. It may be simply sentiment, but it does seem a real pity that anyone should be so far advanced as to consider that live stock destined for human consumption should receive anything but the freshest and cleanliest of foods.—Ed.]

Tobacco-curing in a New Light.

A. M. HOWELL.

THE world is moving forward in tobacco culture, as in everything else, step by step, and it is good for everyone interested in the vile, beautiful, horridly poisonous, consoling, sickening, nerve-satisfying and healthful, universally anathematised, generally profitable, and much worshipped weed, to keep abreast of the progress of the times in its production. Sometimes there is a mis-step, necessitating a backward step, so that we must "go and come again"; but this is the case in all pioneering. A sound theory must always precede good practice, just as mental action must precede performance in all forward movements. Natural instincts and accidental discoveries have played very notable parts in agricultural advancement, but these are not to be depended upon. Nevertheless, the paths of explorers are generally devious, and nearly always require to be straightened out for subsequent travel.

Some Important Discoveries.

We are promised some very important revelations from the United States in the matter of curing tobacco, such as are calculated to upset theories and beliefs that have been for some years past regarded as settled. I will briefly outline what these discoveries are, and indicate what influence they are promised to exercise, and then endeavour to elucidate the old and tho new idea; but would hint at this juncture that discoveries of a radical nature, involving the stability of a deep-rooted or scientific principle, are not always what they purport to be—not so far-reaching. This gentle reflection is thrown on the matter to save the reader from a possible first-blush opinion that the foundations of recent advancement in tobacco-curing have been shaken. This is by no means the case, but the discoveries we are told of are nevertheless important, and will doubtless lead to modifications in the direction of improvement.

The New and Old Theories.

In a published article by Professor Milton Whitney, of the United States Department of Agriculture, a gentleman of the highest order of ability, well known personally and most highly esteemed by the writer of this, it is announced that Dr. Leow, of the same department, an investigator in vegetable physiology, has discovered, first: that fermentation in the pile or bulk of dried tobacco leaf is not caused by bacteria, as has heretofore been generally believed, but by enzyms—soluble ferments of the nature of pepsin, diastase, and rennet—and,

secondly: that these enzyms—two at least, termed oxydase and peroxydase—are destroyed, one at the degree of 150 Fahrenheit, and the other at 180°. Dr. Leow further claims that the curing process should be a comparatively slow one in view of these discoveries.

New Questions to Study.

When it is remembered that the heat of the fire-curing barn is frequently carried to 180°, and by some higher, and quite commonly to 170°, the question naturally arises, in view of Dr. Leow's claim as to the true cause of fermentation, is tobacco leaf injured by these degrees of heat during the first stages of curing—the work of the barn up to drying? That is to say, is the second stage, that of maturing by fermentation in the bulk, hindered or injuriously lessened by this high heat? Is the tobacco completely, or more or less, sterilized? Is it rendered irretrievably so, or will it recover its power and natural tendency to ferment, and if so, will the fermentation be of the same kind, springing from the same cause, or will it be of a different nature, attended with different results? These and other questions crowd themselves upon the inquirer's mind.

The Costs of Experience.

A negative answer to them, to the view of many persons, will be found in the following facts, which are the outcome of the experience of many intelligent growers who cure almost entirely by fire heat. Tobacco that has been fire-cured, even when the degree of 180 and above has been applied during the process, *will* and *does* undergo fermentation when properly bulked in the proper order or condition of moisture. Such fermentation, properly controlled, invariably results in great change in the chemistry of the leaf, and in the improvement of the most desirable qualities of the tobacco—aroma, colour, elasticity, and combustibility. Tobacco may be fire-cured with the high degrees of heat mentioned, applied at the finish (and only then is high heat applied, to hurry the drying of stem and stalk, after the web of the leaf has been cured at a lower degree), and such tobacco will undergo even violent fermentation, necessitating tearing the bulks asunder, cooling, and re-bulking. Fire-cured tobacco exhibits no tendency to mould unless bulked in too moist a condition with free access of air, the same as will produce mould in air-cured leaf.

These are the facts of experience brought out by years of practice on the part of many of the most successful tobacco growers in the Southern States, where most of the fire-curing is done, and where most of the fancy bright leaf of that country is produced. We are aware that a good fermentation is not always secured, but this is the case in all countries and climates, whatever the curing method may be, dependent upon the intelligence and skill of the person in charge, and sometimes on natural causes that may prevail anywhere, as is the case amongst the producers of wine. Fermentation is indeed a scientific matter, requiring the knowledge of the scientist to control and regulate it where difficulties arise from these unseen causes; and when conditions out of the common occur, it is to be expected that the

ordinary unskilled, perhaps, uneducated, or at least unscientific farmer may be in ignorance of its special requirements, and fail to do, at the proper time, what the professional would see at once was lacking. Such untoward conditions do sometimes occur; but more generally the failures are due to timidity on the part of the farmer in the fear of bulking his tobacco in too moist a condition and causing a mould.

The Cause of Fermentation.

At this point it is opportune to suggest the thought that, under the heretofore unchallenged belief that fermentation in the tobacco bulk is caused by bacteria, it has been easy to assume that if the high heat of the fire-curing barn destroyed all bacteria attached to the leaf, the tobacco was at once reinfected with these organisms when softened by imbibing moisture after the barn and tobacco had cooled, and during the plenteous aeration afforded in handling preparatory to bulking. When grape juice is boiled it becomes completely sterilized, as is proved by the fact that it will not undergo fermentation if sealed up in bottles while boiling hot. That it is at once reinfected by the introduction of agency of fermentation from the atmosphere immediately after it has cooled is proved by the fact that the slightest aeration at this time causes fermentation to start up. The same reasoning would appear to hold good, however, let the true cause of fermentation be what it may, whether bacteria or enzyms. There is diastase in the juice of the grape, as well as enzyms in the tobacco, as Dr. Leow has just discovered.

Fire-curing not on Trial.

It is not intended for the reader to understand that either Dr. Leow or Professor Whitney avowed that these discoveries inveigh against the fire-curing of tobacco; but to many people that would be the logical conclusion to be drawn from what has been so far published. This method of curing tobacco is as far ahead of old methods as the railway train is ahead of the old-fashioned stage-coach; and while there is little room to fear that Dr. Leow's announced discoveries and conclusions will stay progress in the pursuit of it in countries where it has been fully put to the test, it is well for beginners in a country like this, where the system has not gained permanent foothold, to avoid being misled by the bare announcement of an important discovery which may be misinterpreted.

The Scientists' Points of View.

In scientific principle Dr. Leow's position with regard to the cause of fermentation in the tobacco pile is directly opposed to what the world has learned to believe. If what is claimed by him be adhered to, we may be treated to something like a repetition of the memorable discussion between two of the world's most illustrious scientific men, Liebig and Pasteur. In the advance article by Professor Whitney, which heralds forthcoming publications on this matter by the United States Department of Agriculture, it is said that "Dr. Leow shows conclusively that fermentation is not caused by bacteria, but is

due to the action of soluble ferments or enzyms." Liebig maintained that matter was capable of a motion or movement within itself sufficient to account for the phenomena of fermentation, and Pasteur that it was in all cases due to the agency of microbes, and never took place in their absence. Pasteur triumphed in proving to the satisfaction of the scientific world the absolute correctness of his views, and "went up head" as the acknowledged leader in that and kindred branches of science. His discoveries in bacteriology modified and revolutionised medical diagnosis and practice, in many important particulars, in every enlightened country on the globe, and caused the most radical changes to be made in the process of various manufactures. No one essays to even proximately compute the value of his services to the health, affairs, and general well-being of mankind, and, though now deceased, the light he kindled and left in full blaze burns brighter with every advance in scientific investigation, and he takes his place in permanent history as one of the world's greatest discoverers and benefactors. Since the time of the great Frenchman, a German investigator has shown that fermentation in the tobacco bulk and the resulting improvement in the smoking qualities of the leaf is due to the action of bacterial organisms. The study of the subject has gone as far as isolating them, and making special cultures of them, and inoculating tobacco piles with them with the view of formulating methods for facilitating the process and rendering it more certain, effective, uniform, and complete.

Through Farmer's Glasses.

The fermentation of tobacco, it may be said, is now, as it has been for some years past, regarded as like most other fermentations that effect a decomposition of organic matter, either beneficially or detrimentally—the work of some sort of micro-organism embraced in the comprehensive name of bacterium or microbe. The fact that it goes through a process of fermentation, sweating, and generating heat when bulked compactly in soft, pliable condition, has been known from a very remote period. The process was superficially understood, carefully looked after, being regarded as a necessary part of the work of producing "ripe" or matured tobacco. The fact that it "seasons" and greatly improves the tobacco in natural flavour and all these points, and virtually all that is now practised in inducing and promoting it were of common knowledge amongst those who produced and handled it long before either microbes or enzyms were known to exist. It is highly probable that it was found out by accident, or merely incidentally, in the early, crude methods of handling, arising from the natural methods of the time of packing it away in any sort of box or bin for future use. Science has only been looking into the matter in recent years, and the now commonly accepted theory of microbic causation has perhaps never before been challenged since it was first announced. It is not for a layman to decide questions of scientific principle, whatever his opinions may be, but on questions of fact, as related heretofore, he is at liberty to give his testimony. Perhaps it is not necessary for the every-day practical farmer to bother his head

with the merely technical point of what is in reality the prime or incipient cause of fermentation, though it may well be claimed that it is better for him to know what is scientific truth in all cases, that he may the more intelligently pursue his many-sided vocation. In this case it may affect his pocket to know which it is that operates upon his tobacco—a microbe or an enzym. If an enzym, and that this is irrevocably put out of commission by 150° Fahrenheit, he had better burn less wood in curing his tobacco; if a microbe, which is omnipresent, he may regard them with indifference in his curing barn, and "chunk up the fire" with impunity. If both these invisible or microscopic things are concerned in the transaction, which is highly probable, perhaps he had better "split the difference" between the two and modify the heat formula of his fire-curing. Limit it to say 140°. This degree is quite sufficient, any way, for those who cure the leaf only, and will prolong but little the time required for curing a barnful of ripe leaves. (See *Agricultural Gazette*, September, 1898, page 1046.)

Be the direct cause of fermentation in the bulk the one thing or the other, the points raised by Dr. Leow are unquestionably important, since enzyms have much to do with decomposition, according to scientific authorities, as shown by the action of pepsin in the digestion of food in the stomach, and by that of diastase in the conversion of starch into sugar in the fermentation of alcoholic liquors. What he has found out, therefore, of the presence and influence of enzyms in tobacco fermentation may throw a valuable light on the subject. Whatever promises a further knowledge of the problems that confront the tobacco-grower, and opens the way to improvement in the production of aromatic leaf, will be welcomed by all, and the discoverer will be entitled to the thanks of tobacco culturists as well as tobacco users everywhere.

Dr. Leow's future report of his researches will be read with deep interest by all who are interested in the subject of tobacco. In the meantime it is the purpose of this article to hint to all tobacco-growers that fire-curing stands in no bad light whatever. It is the advanced up-to-date method of the present time, capable of improvement, of course, but as it stands it is the basis of whatever improvements the future may have in store. It reduces months to weeks and weeks to days in the curing and marketing of tobacco, to say nothing of the superiority of the leaf it turns out, and the expense it avoids. All these points have been heretofore very fully treated in the *Agricultural Gazette.*

Time and Methods of Sowing Tobacco Seed.

Last season's experiences in growing tobacco plants at Nemingha and Moonbi taught the writer some valuable lessons on the subject of seed-sowing in this climate, which, it is hardly necessary to remark, is a very different climate to that from which he came. The season of 1898 was a fearful one in more than one respect, surpassing in severity in one particular—wind—any within the recollection of the oldest residents of the Tamworth district. There was not only the drought but the hot wind, and the force and constancy of it was

amazing. There were some showers in September and October, but there seemed to be a preconcerted trial of resources between the clouds and the wind, like that of the fable between the sun and the wind, in seeing which could first induce the wayfarer to throw off his coat. Every time there was a shower the wind roared with cyclonic velocity and ferocity for days, until every drop of moisture was licked up from the soil. I had carefully sown an ample supply of tobacco seed in August, and the tiny plants were just showing when this fierce conflict of the elements set in with all its splendid terrors. The showers that came only after tryingly long intervals were only moderate, and they had barely been drunk in for an inch or less by the thirsty soil before the hot winds set up a furious gale. It was remarkable that this was the case in every instance. Plants died in their tracks, so to speak, by the tens of thousands. The tops were burnt black even before the roots succumbed, when, by constant artificial application of water, they had been kept alive, and when there was sufficient moisture in the soil to support them. Wild clover, green and beautiful in the morning, was brown and crisp before evening. Plant-bed covers were ripped from the timbers they were nailed to and carried like kites into the woods long distances away. I felt a disposition to blame somebody, or the whole community, for not apprising me of the prevalence of this kind of spring weather, but was not long in learning that it was uncommon, extraordinary. In this there was some consolation, but no succour for my plants. I soon realised the necessity of sowing more seed, and of adopting some plan for forcing them into early planthood, for it was now well into October, though probably six months, at least, until frost, ample time for maturing a good crop of tobacco if I could get plants started at once and favourable weather for growing the crop. Accordingly I placed small handfuls of seed on bags, folded the bags over them a number of times, dipped them in water, placed them in boxes near the sitting-room fire (for it was yet cold weather), watched them closely, and kept them moist by an occasional sprinkling. The seeds were generally sprouted within four days. They were shaken from the bags into boxes containing well sifted soil, were well mixed by hand with this, and the whole then passed through the sieve four or five times to effect thorough mixing. They were then taken to the beds and sown. The beds had been previously well prepared and were soft and mellow, and not rolled. Some of the seeds were so far sprouted that they were showing the cotyledons or two first (seed) leaves at the time of sowing. The beds were not rolled, or in any way pressed or packed, or raked or swept, after sowing, but were most thoroughly watered at once with a coarse-rosed sprinkling pot, the water falling on the soft, freshly fined soil in large spattering drops. The seeds had been sown abundantly, and I depended on the extra heavy watering to wash them, or enough of them, into the mellow soil to insure a stand. The sowings were made on a Saturday afternoon, were at once well shaded from the sun, and protected from the wind with hessian cloth, and left so until the following Monday morning. At that time I lifted the covers and beheld most abundant stands of healthy seedlings, thirty-six hours after sowing,

in the manner described, and six days after the dry seeds were taken from the packets and placed in the wet bags. By this course I had accomplished within less than a week everything that had resulted from more than six weeks of time and no end of watering by the common method of sowing early in the open soil. These late sowings so made gave me in good time most of the plants I had last year. They grew well from the start, and, benefiting by the fate that befell their predecessors, were well protected and suffered no backset. The best tobacco produced in the year's work was from seed sown after sprouting, as described on the 19th of October, nearly three months after the usual time of sowing. This quick method of producing plants was not new to me, and it may not be to many who will read of it, nor is it necessary under ordinarily favourable conditions of weather, but this record of my experiences in producing plants last season may be serviceable to many who have never tried the plan. I shall adopt it and depend upon it in future, not only for tobacco, but other plants as well, with some variations.

It is quite apparent from this experience that much time, labour, expense, vexation, and disappointment may be saved by this procedure. There are other gains by it, too, that are, or may be, of no little value. Late spring frosts may be avoided, a good stand of plants is more certain, time is gained for subsequent sowings in case of mishaps, and, generally speaking, healthier plants are produced. Seed sown early in the usual way are weeks in the ground before they germinate, and only moisture and a warm temperature will fetch them up.

Reflecting on the matter later in the season, I sowed some seed by this plan on the 7th of January, simply as an experiment. They were up plenteously within a few days, and a dozen of the plants were set out in due time, and given every chance to grow by being kept well worked and watered all during the summer's disastrous drought. One of these plants was left untopped, and it came into full blossom before the first killing frost, which was on the 7th of May, when the early planted tobacco of the Chinese residents along the Peel River flats were, like mine of this experiment, cooked by the freeze. Many of the bottom leaves of my January plants were ripe before this cold snap, however, and were cured into good smoking tobacco.

It is unnecessary to relate that notwithstanding the success achieved in producing so late an abundance of good plants in time for a crop, as narrated above, they very largely came to grief in the field in the long weeks and months of parching weather that followed. The drought got in its deadly work, but that does not affect the question of the advisability of sowing late—say the middle of September—by the above or a similar plan. This will give the farmer plants old enough and large enough to transplant by the 1st of November, which is early planting, and will save him a great amount of bother. No experienced farmer needs to be reminded, however, that in depending on very late operations in this manner he must make sure of his work, else he will have trouble at the other end of the line—frost before his tobacco is ripe. Well-made, flat beds, careful work in securing a stand of seedlings, and a plenty of water are the requisites.

The Principal Causes of Deterioration in Potatoes.

POTATOES are, as everyone knows, the enlarged portions of underground roots, where reserve matter accumulates in the form of starch. Propagation always performed by planting the tubercles results in a deterioration, partly due to this constant mode of non-sexual reproduction. It is a well-established fact that in the vegetable kingdom those species which are continually propagated by bulbs or tubercles have a tendency to progressive weakness, and lose by degrees certain of those qualities which they primarily possessed. Therefore, it is necessary at certain times to resort to fecundation to improve the species, and restore its former vigour. Of course this deterioration takes place very slowly, in fact, almost imperceptibly, and it is only in cases of special cultivation in experimental fields, where the diverse species are regularly followed and compared during a number of years, that we can prove easily a progressive enfeeblement. This deterioration depends on several causes, of which we will give a brief resumé.

1. Influence of Soil.

The nature of the soil shows a very marked influence. Potatoes prefer a light and sandy soil, or at least a good open one, and it is only under these conditions that they maintain their shape and colour. In clayey and generally in all heavy soils they become deformed and very irregular, principally in the oblong species; while the red and purple varieties get more or less discoloured, and often become streaky, as we have noted in the "Blue Giant" and "Sausage" species. In compact soils, which retain humidity, the malady takes much more effect, and unless we plant extremely hardy varieties we are likely to obtain a very poor crop. The "Blue Giant" and "Early Rose" are two specimens which are particularly influenced by soil and climate. The first is of German origin (*Blanc Miesen*), and at commencement rivals in productiveness and richness of starch the Imperator species, but if planted several successive years in heavy soil it degenerates, gives a poor crop, and a small percentage of starch.

2. The Climate.

The climate has an influence almost as important as that of the soil. In a damp and warm climate several varieties are specially affected by shrivelling and mildew, diseases which, if they appear early, enfeeble the plant and cause a too early maturity, with a diminished crop. On the other hand, in the north and north-eastern districts of France, the late varieties produce a smaller crop, because, certain years, they have not the necessary time to arrive at their normal maturity. The frosts which often begin early in October arrest the vegetation and the leaves wither and die prematurely, before the potatoes have attained any size

3. Absence of Selection.

This also contributes greatly to reduce the crops, particularly with certain species, which have a more or less accentuated tendency to produce anomalies, the two principal ones being stringy potatoes and potatoes without leaves. The stringy potatoes, which we find in a great number of varieties, are characterised by the presence of sprouts elongating very rapidly and remaining filiform (threadlike). When planted separately they have always given a most insignificant crop. These potatoes, which are easily recognised, should be carefully sorted out. The potatoes without leaves are less common. They occur oftenest in the Marjolin species, and we have found that this variety has a peculiar tendency to form a large proportion of plants where the sprouts, instead of developing into stalks and leaves, swell and form very small tubercles. We have even found the formation of these small tubercles inside the mother-plants. This malformation is caused in various ways, such as immersion in slightly acidulated water, or in a weak solution of sulphate of copper, or even when the sprouting has taken place on potatoes placed in large heaps. In the latter case, we consider the cause of degeneracy to be the age of the species, as we previously pointed out. We have noted the principal forms of deterioration, and will now indicate how these can be prevented in a certain degree. Of course we cannot modify the soil or the climate, but instead of constantly taking the settings from enfeebled plants, procure some from other districts. It is well known as an actual fact that in renewing the settings we obtain a more abundant crop. The selection of the potato is of equally great importance, and if you wish to obtain good results do not take haphazard from the heap the required quantity for setting, or confine yourself to picking the largest you can find, but proceed in the following manner to make a suitable selection:—At the harvest the potatoes are left in small heaps on the field, and for planting only the medium-sized ones from the most prolific plants, and having the most regular shape, should be chosen. If the potatoes are intended for starch-making, they must, of course, be selected from the point of richness in starch. To do this, it is not necessary to have an expensive chemical analysis, but by using a feculometre, by which the density can be easily ascertained, and by referring to special tables, we discover immediately, with sufficient approximation, the percentage of starch. To remedy the deterioration caused by the ancientness of the species, it is necessary to have recourse to seed-beds, but this important matter had better be left to specialists. However, if we wish to be up to date, it is necessary to try new varieties, compare them with those being used, and adopt them if they are really meritorious.

Our advice to agriculturists is, therefore, not to confine themselves exclusively to the culture of one or two old species, such as Blue Giant, Magnum Bonum, Institute de Beauvais, Chardon, Canada, &c. These varieties are actually far behind, in productiveness and richness in starch, the Michter Imperator, and specially the two new species of German origin, the Professor Maerker and the Doctor Lucius. These

latter have been tried with our best varieties in our experimental fields at Grignon, and have given the following results:—

Crop per Hectare.

	Potatoes. Kilos.	Starch. Kilos.
Professor Maerker	34,250	7,179
Doctor Lucius	30,950	7,118
Michter Imperator	25,800	4,850
Blue Giant	24,550	3,977

This result shows the the incontestable superiority of these two new species over the best varieties grown at present, such as the Michter Imperator and the Blue Giant.

In conclusion, we give the following directions for obtaining a good result:—

(1.) Choose varieties specially suited to soil and climate.

(2.) Make small experiments with the best new species recommended and tried at the Agricultural Stations.

(3.) Choose the seed-potatoes in the manner previously indicted.

(4.) If, at the end of a number of years, notwithstanding careful selection, the production seems to diminish, renew the seed, and get it from countries of different altitude and climate.

(5.) Combat the disease caused by the *Phythophtora infestans*, by treating the plants with copper solutions. Two applications are necessary. The first, before the flowering; the second, three weeks or a month after.—Denaiffe, in the *Journal of Agriculture, France.*

Seed Corn.

"Many farmers owning both bottom and upland corn-fields," writes Mr. J. M. Westgate in the *American Agriculturist*, "make the mistake of using the same seed on both kinds of soils. Corn which is adapted to the soil and moisture conditions of the valleys will not do so well on the upland as will some variety that has by several years of cultivation and selection become adapted to the conditions there. It is for the same reason that large Colorado potatoes that have been grown for years under irrigation will do so poorly when used for seed in Kansas without the accustomed supply of water. It is generally the case on the farm that the corn from all the fields, both upland and bottom, is cribbed together. When the time for seed selection comes, the largest ears are picked out, irrespective of the kind of soil that grew them. As the bottom land produces the larger ears, it is more than likely that the bulk of the seed will be from the lower and moister portions of the farm. This is the proper seed for the lowland, but it is not so well adapted to the dryer and poorer upland as is seed that has been raised there.

"It is advisable to select the seed either before or at husking-time, when not only the quality of the ground but the character of the individual stalk and ear can be taken into consideration. As has been suggested before, a small box attached to the side of the waggon-bed into which the desirable ears can be thrown is the most practical device that can be recommended. By a little judicious selection for a series of years, a strain can be established on the upland portion of any farm which will be well adapted to that and other soils similar to location and composition. An eight-inch ear from the upland will ordinarily prove better for planting on the upland than will a twelve-inch ear from a draw in the lower portion of the farm."

Ducks.

J. J. McCUE.

Breeding, Rearing, Feeding, and Management.

THE best known varieties of ducks in the Colony, are the Aylesbury, Rouen, Pekin, Indian Runner, and Musk or Muscovy. All these breeds do well in any part of the Colony, and are to be found in the hottest as well as the coldest climates.

The Aylesbury.

The Aylesbury, according to all recognised authorities, originated and received its name from the county town, Aylesbury, of Buckinghamshire, and has belonged to the neighbourhood longer than the oldest inhabitants can recollect.

There is only one variety, the white Aylesbury; their plumage being of a pure white, the slightest discoloured feather being a disqualification. One peculiarity in this breed is the variation in the colour of the eggs laid, some being pure white and ranging to a perfect green; and stranger still, one duck will often lay both colours. Selection and breeding will do a great deal to get an uniform colour of eggs, let it be either a white or green that is preferred. Their legs and feet should be a bright orange, the bill long and of a fleshy pink colour. The head should be full, with the bill nicely fitted on to the skull, so that the bill should show nearly a straight line from the top of head to point of beak. The eyes should be full and black in colour. Body should be long, broad at shoulders, neck long and slender, the keel or breast bone should be long and perfectly straight. Drake and duck vary only in the drake showing a curled feather, or two, in the tail, and being larger than the duck.

The Aylesbury is the market duck of England, and from late accounts, the Vale of Aylesbury is loosing its pre-eminence for duck-raising; large numbers being raised in Norfolk and Surrey, and other places. Most of the ducks that find their way to our markets are more or less Aylesbury. As a layer, the Aylesbury is not as good as some other breeds; on an average a duck will lay eighty eggs in a year. Of course, individual ducks have been known to lay 180 eggs in the year, but they are so scare few see them, but we can *hear* of them often. The egg-production of all ducks can be increased and brought up to a good standard by selecting and breeding only from the top layers. Aylesburys require a lot of watching to keep them up to a payable egg-production.

Rouen Ducks.

The Rouen, as its name suggests, came from Rouen in Normandy; in colour, it is the same as the wild duck or Mallard of England.

The drake of this variety is a very handsome bird when in full plumage. The head is a purple green, this colour running down the neck until it meets a broken ring of white—the ring must not meet at the back, and should be clearly defined. The breast should be a deep claret-brown extending well down and as free as possible from broken markings, verging into a French grey on the lower part of the belly and underparts. The back, rich satiny greenish black, the curled feathers in the tail a darker green. Legs and feet bright orange colour, and bill yellowish green.

The duck varies in colour during the laying period, often appearing dark-brown or black. The head should be brown, with two distinct lines on either side, starting from the eye and extending down the neck some distance. The breast, brown ground colour, pencilled over with darker brown. The back a brown ground colour, pencilled with very dark-brown. The ribbon, or wing-bar in both sexes should be a bright blue, edged on each side with a stripe of pure white. The drake and duck should be well "keeled" as described for Aylesburys.

This variety, like the Aylesbury, varies in colour of eggs from white to deep green. The Rouen does not lay quite as many eggs as the Aylesbury; a fair average for a duck would be seventy eggs in a year; but I have had pens that averaged ninety eggs in a year. It does not mature as well as the Aylesbury or Pekin, or is it as saleable for market purposes, on account of the dark pin feathers. The quality of meat is equally as good as the Aylesbury or Pekin; still, the consumer calls for a white-bodied bird, and a carcass that is white and pleasing to the eye.

The Pekin.

The Pekin variety differs from all others in its shape, carriage, and colour. It is of a peculiar boat-shape, long in body, broad in breast; the legs, rather short and set far back, which makes the bird walk partly upright. The neck is long, fairly thick, head large, legs and beak yellow, or reddish orange; the plumage is a kind of canary or cream colour. The pure Aylesbury white that we see in some birds, comes no doubt from crossing with the Aylesbury. The original and pure Pekin has a canary or creamish colour, which is easily seen if the feathers are brushed open with the hand.

The Pekin is *the* duck of America—and should be so here, for its qualities are above any of the other breeds. This variety grows to a large size, is an excellent table bird, and is the *best layer* of any variety. It grows, and matures quickly—pairs from *good* strains often weighing 16 to 18 pounds the pair at six months old. A fair average laying would be 100 eggs per duck in a year; the ducks seldom show signs of broodiness as other varieties do, hence the greater number of eggs laid.

Indian Runner.

This variety is not as common in the Colonies as the above breeds. The credit of introducing this breed into New South Wales belongs to Mr. Harald Cadell, who imported two birds from England in 1896.

This breed is an excellent layer, good forager, always "on the go," searching for food. If allowed a fair run, they mature early, and, what is more, lay early. They are not recognised as a table duck, being rather small; their flesh is of a gamey flavour, and is preferred by some to the meat of other breeds. Good ducks of this breed will average ninety eggs in a year; the eggs are of a good size for so small a duck.

The Musk, or Muscovy,

Is a breed that is fairly well known in the Colony. They are the largest duck we have, the drake growing to a large size and weight. The duck does not grow nearly as large as her mate, and lays from thirty to forty eggs in a season. A peculiarity about this breed is that their eggs take longer to incubate than other ducks, namely, five weeks.

This breed seems to be a distinct species, as the progeny of a cross between this and the common varieties is generally infertile.

Breeding and Rearing.

In breeding ducks the duck-raiser should commence with good stock birds. Whatever variety he chooses should be of the best, for the after success will depend on the quality of the breeding birds.

To breed good ducks you must have good, large, healthy parents—birds that have had no stop in their growth from the day they left the shell till fully matured. The breeders should be from a good egg-producing strain and fully matured. Opinions differ as to the proper age for breeding ducks. I have had good results from birds in their first year, which many condemn. Birds in their second laying give no stronger birds, the only difference being that they feather a little more quickly. My experience is this: Breed from birds in their second laying to produce breeders or show birds, and from either first layers or second layers for market birds. Mate drakes in their second year with the young ducks, and first year drakes, if strong, vigorous, and fully matured, with the old ducks. Four ducks to each drake is about the proper number to use to get good strong ducklings. Later in the season, when the ducks are easing off duty, six, or even eight, ducks to a drake may be allowed. The fertility of early duck eggs seems to be the great "rock" with most duck-raisers; but if we feed properly, mate properly, and see that all their wants are supplied, there will not be so many infertile eggs.

Ducks lay as well as many breeds of fowls, but they perform the work quicker, and rest the remainder of the year, while the hen extends her laying throughout the year.

All poultry deteriorate very quickly through natural causes; in fact, more so than other animals. Many duck and fowl breeders say "that it is absolutely necessary to introduce fresh blood every year." I beg to differ, especially in ducks. I have made many careful experiments, and found that in-breeding, managed properly, is beneficial. When I use the word "in-breeding," I do not mean that you mate very close relationships, but when you have five or six unrelated drakes to commence with at the head of the harem, you can pick out of the ducklings

from this pen what number of large young drakes you wish to keep for breeders. Mate these young drakes with the old ducks, and the old drakes with the young ducks you have picked out for breeders. In this manner you can go on for years without fresh blood. Yet another way: divide the flock into unrelated pens, with 2 ft. wire-netting; by this method the small pens will not fret, for they can see each other through the wire, so feel contented.

To get the best results from ducks, the breeder should select—like the pullets—from the earliest hatched, and from his best layers. In making the selection, do not condemn an early hatched duck for it being a "bit on the small side," for very often the best laying ducks are small in size.

Raising ducks for market is a very profitable branch of poultry raising. Ducks can be raised more quickly and easily than chickens, and with less loss, besides always bringing a fair uniform price the year round.

To rear ducks in numbers you should use incubators and foster-mothers, and give special attention to the feeding and housing of the ducklings, till at least a month or five weeks old. There are six things to be remembered always in raising ducks: First, that the ducklings reared for breeders require different treatment to those reared for market purposes, as the two methods differ greatly; second, clean water; third, proper food; fourth, proper shade and accommodation; fifth, cleanliness everywhere; and, sixth, grit and green food.

There is no doubt but that duck-raising will pay, and pay well, if the right man or woman is at the head of affairs: it is a losing business when managed in a careless way. Hens will stand more mismanagement than ducks, for they will lay a few eggs; but ducks will not pay unless the owner gives them proper attention and management. Ducks are great eaters, and must get that appetite "filled every time," if we wish to get proper returns and profits. It costs about 6s. to feed a duck one year; so to get a profit on that from each duck, "we have to watch 'em," yes, every one if possible, to see if we are getting a profit on our expenditure. Many may say they "can feed a duck for one year cheaper than 6s." Some may; but I have tried most of the cheap methods of feeding ducks, and got "cheap returns" for my pains. No; feed good, sound food, and give them a fair and full ration, and you will get a fair return for profits. Many duck-raisers use corn for evening meal for their ducks. This is wrong. Ducks are not grain eaters, for a duck has no crop; it cannot assimilate or thrive on grain feeding.

Feeding.

Feeding is the regulation of health and profit. Ducklings can be raised easier and with less percentage of loss than chickens, and if properly cared for and fed will be as heavy at nine or ten weeks old as fowls at eighteen weeks; so it is easily seen which grows the more quickly.

Ducklings do not eat so soon as chicks after leaving the shell. They should be fed the first three or four days on hard boiled egg (infertile) and stale bread crumbs. After the fourth day they should be fed

liberally on soft food made up as follows:—Pollard or oatmeal and stale bread—three parts of the latter to one of the former. The bread should be well soaked in water and squeezed dry—then add the pollard or oatmeal, and mix in to a nice crumbly state. After the first week the pollard or oatmeal can be increased to half pollard and half bread (if you have it). If no bread—use three parts pollard and one of bran, or equal parts pollard, barley meal, or corn meal, to the one of bran, mixed with soup. Twice or three times a week meat or livers cooked well, so that it can be shredded fine to mix in soft food—the soup or gravy being saved for mixing the soft food. Green food cut fine three or four times a week—every day if you can give it—will save a little in the meal bill. Some feeders advise mixing sand in the soft food; I believe in giving them clean food, and letting them eat the sand after, by always having clean sand where they can get it.

Ducklings do not require a large pond of water, shallow pans or troughs two or three inches deep being sufficient, and should be so made that the ducklings cannot get into it, only when the owner wishes to let them have a wash.

They should be kept dry, and not allowed out in the rain for the first fortnight, and should be penned while young; if not, they will "run their legs off."

Four or five meals a day for the first five weeks is about the proper number, and three or four meals afterwards till marketed. Ducks should be fit for market at from nine to twelve weeks old, for soon after that, the pin-feathers begin to grow, when they "go off" in condition, and become light. If not marketed at ten or twelve weeks, it means keeping them till they are about four months old.

Ducklings will stand confinement better than chickens, and always have a "shark's" appetite, are not so dainty as to quality of food; still, all ducklings should be fed only clean wholesome food.

Last year, I made an experiment with ten chicks, compared with ten ducklings, and forced both lots with extra feeding—and the result was as follows:—

	Duckling. lb.	oz.	Chick. lb.	oz.
1 week old	0	$3\frac{3}{4}$	0	$2\frac{1}{2}$
2 ,, ...	0	8	0	$4\frac{3}{4}$
3 ,, ...	1	1	0	7
4 ,, ...	1	8	0	11
5 ,, ...	2	4	0	14
6 ,, ...	2	11	1	3
7 ,, ...	3	$6\frac{1}{2}$	1	8
8 ,, ...	4	$1\frac{3}{4}$	1	$12\frac{3}{4}$
9 ,, ...	4	6	2	2
10 ,, ...	4	11	2	$4\frac{1}{2}$

The chicks received the same amount of food as the ducklings, and it cost a shade over $2\frac{3}{4}$d. to grow each pound of carcase.

The ducklings were Pekin x Aylesbury, and the chicks Silver Laced Wyandottes.

After the tenth week, both pens did not put on flesh as quickly as previous weeks.

When the ducklings are about six weeks old they should be divided into two flocks, picking those you wish to keep for breeders, and those

that are to be fattened and sold. In picking the breeders, choose those that have the largest and longest heads, and longest and fairly thick necks, for these are the ducklings that make the largest and best birds. Those intended for breeders should not be fattened, but fed three good meals a day, animal food three or four times a week, plenty of green food, and should be kept in flocks of twenty-five—each flock of the one sex.

The ducklings penned for marketing may get four, or even five, rations a day, and the proportion of corn meal can be increased, as well as the animal food, and a daily supply of green food. If the animal food is sweet and clean, it will improve the flavour of the flesh. These can be penned a little closer than those for breeders—thirty can be penned together, or as many as fifty—if in good sized pens where all can get their fair share of the "tucker."

Fifty ducklings, from good parents, if well cared for, will weigh 200 lb. at ten weeks old, and this will cost less than the production of the same weight of pork, which will take twenty or twenty-five weeks to produce in a single pig.

As to the age when ducks cease to be profitable as breeders, opinions differ. I have proved that vigorous birds can be profitably bred from four-year old birds. At seven years of age, the breeding duck is about on a par in vigour and productiveness with a hen four years old.

Management.

The management of ducks is not so troublesome as fowls, or is it as costly. Contagious diseases are unknown to the duck tribe; the only weak part of a duck is its legs. Grain feeding generally causes leg-weakness, and the birds break down, droop, and die. A duckling well hatched is half raised. This means that if the egg has been properly incubated—proper temperature and moisture being kept from the first day up to the last—a strong and normal bird will be the result. The next half of the raising is done in the running and the temperature of the foster-mother. The birds should never be overcrowded, nor should they be neglected in the regular feeding of meals. A fortnight or three weeks will be long enough to leave the ducklings in the foster-mother if the weather is favourable. After leaving the foster-mother they should be housed comfortably every night, and ample room given them, for they grow very fast.

The ducklings for breeders should be picked out and given a more nitrogenous food than those intended for market. The ducklings for market should be kept growing quick, and be fed a more carbonaceous food, and the day they are ready for market should "go." All ducks as well as fowls should be sent to market when ready; every day kept afterwards means "eating" at the profits. I have known duck-raisers to keep ducks for five and six weeks after they were ready for market, waiting for a better price. They got it, but they did not consider that the increased price did not pay them to keep the ducks. They had better sold when the ducks were ready, for it cost more for the extra keep than what was received in the increased price.

The Bees' Home.

ALBERT GALE.

Not the home of the bees,—their habitat; that would necessitate my writing of the species *Apis mellifica,* and that would require a description of the habits of *dorsata, fasciata, mellifica,* and many others having social habits, and also of the varieties these have branched off into—the leather-coloured Italian from the north of Italy; the golden Italian, from the south of that peninsula; the Cyprian, from the island of that name; the Carniolian, from Hungary; and our old friend from England, the black bee.

I was asked the other day by a lady, what is a bee like? is it anything like a blowfly? I then began to ponder is it possible in the eleventh hour of the nineteenth century that there are people who do not know anything about bees—the hive bee especially. If I had been asked if there are any other bees besides the honey bee, it would not have set me thinking so much. It is not to be supposed that people who eat honey can have any interest in the solitary bees—the mason, the carpenter, the upholsterer bee, &c. Then I thought, well, but everyone are not bee-keepers. What is so very familiar to me and other bee-masters cannot be universally understood. One time I turned up a school book of object lessons that was written by a lady, and it said "a bee is an insect with two wings," and I have turned up some of the latest works of natural history and I find they are still perpetuating old theories about the honey bee and its home, and why the cells in the comb have six sides. Most people believe what they read, but that is not always a wise thing to do.

Let us take a ramble to the bees' home, and see who and what are there, what they are about, and how long it takes to perfect some of their productions. Turn over some previous articles and you will see several patterns or styles of bee-hives. Come out into my garden with me and have a look at some of them in the wood instead of illustrations on paper. There is an old-fashion Langstroth, and here is a very modern Langstroth with all the latest improvements. That one? Oh, that is a Heddon. I don't want you to look at the hives; I want to give you an insight of the interior and what is going on there. Are these bees going in and out of that hole? Yes. I want to draw your attention to these. You see that one with lumps of yellow clayey-looking material on her hinder legs. Well, that is pollen; they get it from the anthers of flowers. Many people think it is the wax, but it is not. It is the stuff they make bee-bread with. What is bee-bread? When we open the hive I will show you some and tell you all about it. There are some bees going into the hive without, apparently, any load, but I notice they are well laden, but the cargo they are taking in is honey.

Look, I will catch one of the bees that is outward bound, and show you; I must kill her or she may sting you. Her body (I am not going to use any scientific terms) is formed with six horny rings; these are slightly over-lapping each other. If I caught that bee away from her home I should know she was going out to work, because the rings are close together and rather over-lapping. Now look at this one; she has just returned from her field labour. Her body is longer, and there is a little whitish mark between each ring; that tells me that her honey sac (she carries that internally) is full of honey. From those markings, if I caught her in the street, I should know she was going to her home. What is that—that one covered all over in yellow dust? That is pollen too. It differs from that carried on the legs. The pollen they carry on their bodies in that way is dry and floury, and they cannot kneed it into little pellets, and stow it away in the pollen baskets on their hinder legs. Pollen from some plants is like damp flour, and from others like dry sand; the former they can kneed into balls, the latter they carry home between the hairs of their bodies. That little furry bee just gone out is a young one; that one there is more shiny—she has not so many hairs over her body; that is the effect of old age and other causes. That big bee just outside that box—is that the queen? No, that is a drone, or male bee? I can catch him alive; he has no sting. You notice he has seven horney rings to form his body. He has larger eyes and longer horns than the workers. Those bees in that hive there are not like those? No, that is the English black bee. These here with four bright golden bands on their bodies are the golden Italian bee. Look, these bees working in this hive have all sorts of markings; some have two yellow rings, others have three. There is one all black, and there is one with four golden bands. These are cross-bred. Yes, all these varieties readily interbreed, one with the other. I thought cross-bred animals would not reproduce? Yes, they will; it is hybrids that do not often reproduce. Is there anything more you would like to know about these bees that are flying in and out of the hive? No; only I notice that some of the bees have much shorter wings than the others. They are old bees, and their wings are much worn with constant use. You must remember the number of trips they make daily, and the many miles they have to travel.

Well, now let us have a look inside at the bee nation, so poetically described by fanciful writers; but it is not a nation—it is only a home where dwells the mother, the father, and the children. No; that is wrong. There is no father. He is dead. Bee progeny is always posthumous. There are drones in here, but they are not fathers. You see, this is a 10-frame hive; it is too large for around Sydney. I will lift the quilt at one corner and blow in a little smoke. You will note the Why and the Wherefore further on. That dark sticky stuff on the top of the frames that makes the quilt adhere so firmly is termed by bee-keepers bee-glue. It is a substance bees procure chiefly from the buds of trees. There is not much in this outside frame but honey. That glistening liquid is the new honey they are just bringing in. Those cells on the top of the frame are filled and sealed over. They will keep that for winter use unless it is required earlier. You will see

these cells on the outer parts of the comb are larger than those more in the centre. The larger ones are drone cells and the smaller workers'. There are not many bees on this frame; we shall find more towards the centre of the hive. Here, look! These bees hanging down in a festoon like a chain are wax workers. Oh, beeswax is a secretion that forms in eight little pockets that are found in the under part of the body of all workers, but not in the queen or drone. Let us take a frame from the centre of the hive. I shall find all we want to see there. Yes, just as I expected! Here is brood in all the stages of development. See the little white specks at the bottom of these cells? No? Here, let the sun shine in on them. I thought you would see them then. These are the eggs the queen has laid either to-day or yesterday. These little fat fellows curled around in the bottom of the cell are bee grubs a few days old. These big fellows that almost fill up the whole cell have nearly completed their grub stage. Where the brow caps are on the cells are the young bees in their last stage of development. Here is one that is just eating her way out. That little woolly fellow, after about twenty-one days of imprisonment, has just come out to see what the bee-home is like. These light-coloured woolly ones that are running about more nimbly are older. They are now engaged in the duty of feeding their younger brothers and sisters. They have not been out of the hive yet. They don't go out to work till they are about 14 days old. They then give up their nursing duties and become field labourers. Those capped cells that stand out more prominently? Oh, there are young drones in there, they will remain in the cells about forty hours longer than the worker; you see the cells are more bulky every way than the workers. That dark substance in these cells is bee-bread, made from that pollen you saw the bees carrying in on their hinder-legs. That, eaten by the nurse bees, with a little honey and water added, is the material the young bees are fed upon whilst they are in the cells. No, these big bees out there are not queens, there is only one queen. Well, there is very likely to be one or two unhatched queens; these are always more or less present in the spring and also in summer, if the season is good. Why are there so many drones, when there is only one queen? You will learn that further on. That long bee there is the queen. The first you ever saw? Yes; she is easily picked out when you know her. Not much difference, only much larger? To you there may not be, but I can see a vast difference between her and a worker even externally. True, she has six rings to her body, and four wings and six legs, the same as a worker. Those two legs nearest the head of the worker are very similar to those of the queen. They both carry little combs in them for the purpose of cleaning their horns (antennæ). In the hinder legs of the queen there are no baskets to carry the pollen, neither has she those little nippers for removing the wax scales from the pockets that the worker has. The middle pair of legs in the worker contains a crowbar to lever out the pollen from the baskets. This is not so with the queen. The legs of the queen and the drone more nearly resemble each other than those of the queen and the worker. I will pick up the queen by the

wing. I must handle her very gently or I may injure her for life, or she may become what bee-keepers term a drone layer. Oh, yes, she has a sting, and a very formidable one too. It is the drone has no sting. No, she won't sting. She can if she wishes to, but as a rule she only uses it on rival queens; her sting is not like that of the worker—that is straight, like a fine needle, but the queen's is somewhat curved. You would like to see the cell the queen lives in? She does not live in a cell. Her home is anywhere in the hive; but usually she is to be found on comb, in the cells of which she is laying. That large knob there, something like a lady's thimble, is a queen's cell; that is the cell from which one will be hatched. She will be out in a day or so—sixteen days from the time the egg was laid till she emerges from the cell. That cell like an acorn-cup is one from which the queen has emerged. No, they won't use this cell a second time. Well, I think now we had better close them up, they are getting restless. Those bees you hear flying around you, making a sharp, shrill noise, have just returned from field labour, and they cannot understand what we are up to. Further on, you will find the whole theory of this in detailed or in practical and scientific language.

(To be continued.)

Passion-vine Rearing from Seed.

Mr. Sebastian Hermann, of Birrilee, *via* Arcadia, has been good enough to send the following advice with respect to rearing passion-vines from seed. In the first instance care has to be taken to gather fruit only from such vines as have borne fruit of good size and in plenty in previous years. After this is done, quarter the selected fruit and set the pieces to dry on a board. Now prepare the seed-bed. Select a piece of sandy ground, or, if such a spot is not available, choose a place where the soil is very free, and is not likely to cake after each rain. Most soils can, however, be made suitable for the purpose if a liberal dressing of wood ashes be applied and thoroughly well mixed through the soil. Manure the seed-bed with *well-rotted* horse or sheep manure only until the plants attain a size of about 3 inches above ground. Before setting the seed, soak it for twenty-four hours in urine. Sow the seed in drills, 18 inches apart. This will leave room for attending to the young plants and manuring them until they are strong enough to transplant.

FRUIT-DRYING.

Showing a small portion of the drying-ground of Dr. Joseph Jarvis, of Riverside, in California, of which I had the management for many years. This was situated in the foot hills, just outside of the settlement. In the cutting sheds 100 apricot pitters were employed, and 20 tons of fruit were handled daily.

When the apricots were just about dry they were taken from the drying-trays and emptied into the large flat tray shown in the cut, where they remained about a day, or just long enough to finish drying. They were then scooped into calico bags, holding about 60 lb. of fruit each, sewn up, and in this way sent to the packing-house, where they were left unopened until ready to be packed into the cases, or perhaps they were sold in the bags and sent to Chicago or New York in 10-ton trucks, there to be packed and distributed.

Fruit-drying.

W. J. ALLEN.

THE subject of fruit-drying is a most important one to all orchardists, as hitherto the grower has been content to market his fruit in the fresh state, and has had to take what prices he could get, which were often very low, and in many instances scarcely paid the freight and marketing. In a colony like this with every advantage of climate, there is no necessity for the grower to plod along in the old lines laid down by his father and his grandfather before him, content with whatever he can get for his fruit, and satisfied that so long as it is a peach, or a pear, or an apple, or an apricot, as the case may be, that one variety is as good as another. Let him ascertain which are the best varieties for their respective purposes. These are good for dessert—well, plant as many as he thinks he can dispose of in that way; those are good for export—well, plant a certain number for that purpose, and for the rest of his trees plant such fruits as can be dried.

It is significant of the little attention which the subject of fruit-drying has received in this Colony that we are dependent almost entirely upon other colonies and countries for our dried fruits. This ought not to be where there are so many thousands of acres admirably adapted for raising fruits suitable for drying, as well as the climate necessary for producing the best dried fruits. In fact, in many of the interior districts the climate is so well adapted for fruit-drying, owing to the absence of fogs and moisture in the air, that the drying process could go on day and night. This lessens the chance of the moths depositing their eggs in the fruit, as it is not exposed for so long a time, and has also this advantage—that the fruit drying quickly, the trays can be emptied sooner than they could be in moister or cooler climates, and this enables the grower to handle a large crop with fewer trays, a great consideration to all orchardists.

Last year Victoria produced about 950 tons of raisins and 160 tons of apricots dried, while New South Wales did not produce 10 tons. True, there were 150 tons of raisins dried in New South Wales; but the grapes were grown in Victoria, the fruit dipped before crossing the border, and then dried and packed in this Colony. Apricots also grown in Victoria have been brought over and dried in this Colony, and all this fruit found ready sale at good prices when placed on the markets here. It is greatly to be regretted that we, in this Colony, are so far behind our neighbours. This industry, when it attains the prominence which it deserves, will not only be a source of considerable revenue, but will also furnish employment for hundreds of people.

Dried fruits of all kinds are bringing very remunerative prices at present, the last two years being exceptionally good ones for those engaged in this industry. One of the largest brokers of Melbourne handling dried fruits is reported, in an interview, to have given it as his opinion that, when federated Australia is supplied, Mildura sultanas will hold their own against the world even in the London market, and that, compared with the Mildura sultana, the imported fruit is in every way inferior. This statement is further borne out by the quality of the sultanas which we cured at the Wagga Wagga orchard last year. These were pronounced to be exceptionally good by all who saw and tested them. Samples of these were on view at the Royal Agricultural Show, placed side by side with the best imported sultanas which the writer could purchase, and the difference in quality was so great that not even the most casual observer could fail to be struck by it.

Apricots, if the sample is a good, even one, will always sell well. About four years ago I had packed for Chaffey Bros. (Ltd.), in 2-lb. boxes, about 1 ton of Mildura dried apricots, which I had dried, and which sold in the old country at 20s. more per hundredweight than the Californian dried product. In citing these instances my object is to point out that, while Nature has been generous to us in giving us all that can be desired in the way of soil and climate, up to the present time the fruit-growers of New South Wales have not had sufficient go in them to take up this most important but very neglected industry.

Great care must be taken in the selection of trees, keeping in view the necessity for choosing such as produce the best drying fruits—that is, for colour and size, and such as will lose the least weight in drying; one of the objects—in fact, the main object—being to produce a dried fruit of good size and bright, clear colour, which, when graded and properly packed, will present the most attractive appearance.

The previous remarks apply mostly to sun-drying; but, in districts where this is not practicable, good results may be obtained by drying in the evaporator, and where this process is used it has the advantage that, with careful handling after the fruit is dried, there is very little risk of the fruit becoming infested with moths.

In the next *Gazette* I hope to say something about fruit-growing under irrigation.

Apricot-drying.

As previously suggested, the planter should choose and grow only those kinds which make a good, bright, clear-coloured, large fruit, and one which does not dry away too much during the process. To begin with, the tree must receive, from the time of its planting, the necessary care and attention to enable it to produce a good crop of the very best fruit, both for quality and size. Small undersized fruits are more expensive to handle, they never find such ready sale, and they sell at about one-half the price of fine, bright, even fruit. This necessitates systematic and judicious pruning and thinning. If it is seen that a tree has set too much fruit, or more than it can possibly develop

properly, pick off or thin evenly over the whole tree, leaving only such quantity as the tree will properly develop.*

If irrigation is carried on, and the climate is very dry, do not be afraid to irrigate the trees at the time of ripening if they appear to require it, as a little neglect at this particular time may make a great difference in the quality of the dried fruit. Experiments have shown that irrigated fruits do not dry away as much as non-irrigated—the former in a recent experiment taking $4\frac{2}{10}$ lbs. of fresh to one pound dried, whilst the non-irrigated took $5\frac{6}{10}$ to one pound dried. Some varieties, of course, dry away more than others; the above experiments were made with best drying varieties. In a cool, moist climate I would recommend the orchardist to pay particular attention to his cultivation. To make the best dried fruit, allow the apricots to hang on the tree until they are perfectly ripe, but not over-ripe, or so that they cannot be cut in halves with a sharp knife and still retain their shape. †When the fruit is fairly soft, pick it carefully into cases; this will necessitate going over the trees five or six times in all probability. As soon as possible have the cases carted to the cutting-shed, where the fruit should be carefully and evenly cut in halves (not pulled apart) and the pits removed. Place evenly on the trays with the cut side up, and as soon as possible remove each tray to the fumigator, where it may remain, with the door closed, until the fumigator is sufficiently full to start the sulphur burning. This is of the utmost importance, as when once the fruit has been cut it must not be exposed to either sun or wind. When everything is ready, place sufficient sulphur or brimstone to fill the room with the fumes for about three hours (from 1 lb. to $2\frac{1}{2}$ lb. according to size of room); but if possible allow the fruit to remain in the sulphur-room from eight to ten or twelve hours, or until the cup‡ is full of juice. It can then be taken out and placed either in the sun or in the evaporator (as the case may be) immediately. If in the evaporator, do not place the fruit in the hottest part to begin with, but gradually work from the cooler to the hotter part (say) starting at that part which is 140 degrees, and finishing off at 160 degrees or 170 degrees. In this way the fruit will dry in from fourteen to eighteen hours, but the greatest care must be taken not to allow it to burn, and some practice will be required to tell when it is just dry enough.

If the fruit is to be dried in the sun use wooden trays, 2 ft. x 3 ft., which are made for the purpose, with a 2-inch cleat at both ends. These are easily handled, and can be used in connection with all fruits.

* I would advise that this thinning should be done at two different times, the first thinning to be done about three weeks after the fruit is well set, and a final thinning when the stone is well formed, as in stoning very often the tree thins itself, a good many of the fruits dropping at this period.

† In harvesting apricots for drying we used to have, at Riverside, California, a gang of six men with a sheet placed underneath the tree ready to receive the fruit. The tree is then slightly jarred with forked poles, which are carried, one by each man, and when all the ripe fruit is shaken the sheets are taken up, and the fruit gently poured into cases, holding about 35 lb. each. With a large staff such as we had there, of about 100 pitters and 30 pickers, we had apricots cut and in the fumigator two hours after they were shaken from the tree, so that any slight bruises were not noticeable on the dried fruit.

‡ That is the depression where the pit was removed from.

In cutting the fruit and placing it on the trays, place it on the top part or so that the cleats at the ends will be resting on the ground, thus allowing a current of air to pass underneath and assist in the drying process. If the weather is hot, which it usually is about Christmas-time, it will take from two and a half to three and a half days to dry the fruit, which will require to be sorted over, so that any which is not quite dry may be put on other trays and allowed to stand for another half-day or so. The dried fruit should be taken from the trays and put into clean calico bags immediately and securely tied, so that the moths may not reach it. When sorting over in the above manner, any fruit which is small or of bad appearance should not be mixed up with the good, but sorted out and marked as inferior; while the good also can be marked accordingly. When the fruit is dried and bagged it should be at once stored in a cool, dry place; if exposed to heat it will become hard, lose in weight, and deteriorate in quality.

Should, by any mischance, the moths have got into the fruit and deposited their eggs therein, an effectual means of cleaning or ridding such infested fruit is to dip it into boiling hot water for a few seconds, and then spread on trays and allow to dry by exposure to the sun's rays for a few hours.

Fruit thus dipped will not keep its colour long, consequently it should be disposed of as quickly as possible.

Peach-drying.

The process of drying peaches is very similar to that followed with apricots, but there are so many hundreds of poor varieties grown that it is very difficult to find peaches that make a first-class or commercial dried fruit. A freestone is really the only variety to grow for drying purposes, and one with a firm, yellow flesh, not too juicy, and above medium size. A peach of this description will make the very best commercial article, and one which when properly dried and packed would bring the highest price. A clingstone peach will dry, but will not sell so readily, and brings a much lower price. It is true it will not dry away so much, but with the market as it is, with keen competition from America, it will not pay the grower to place an inferior article on the market, for three reasons, viz.:—(1) Inferior fruits placed upon the market tend to lower the prices of good fruits; (2) they sell at such low prices that it barely pays the grower for his work in picking, curing, packing, and marketing; (3) they are usually the last fruits on the market to be sold, and very few wholesale dealers care to handle such fruit, and, in consequence, will accept almost any offer to get rid of it.

I have in previous articles named certain good varieties which are especially worthy of notice.

Although in California peeled peaches have always brought a much higher price than the unpeeled, they have not, in Victoria, sold for sufficiently more to pay the grower for the extra trouble of peeling, and in consequence nearly all dried peaches found on the market are unpeeled. With some varieties it is found that the skin will slip off

quite easily with a slight pressure of the thumb and finger immediately after the fruit has been fumigated, while other varieties require the use of a peach-peeling machine.

For drying, the peaches should be cut evenly in halves, placing them on the trays with the cut side up, in every way similar to the apricot, except that at the most, they only require two hours' fumigating; but if desired they may remain for a longer time in the sulphur-room, by opening the doors and allowing the air to circulate freely through the trays, after which they are placed in the evaporator or in the sun, as the case may be, and exposed to the same temperature as the apricot. They should be removed from the tray while quite pliable and not allowed to over-dry, then tied in calico bags and stored in a cool, dry place until ready to pack. If peaches are very uneven in size it is best to keep the different sizes together on the trays, as they dry more evenly than if the large and small fruits are mixed on the same tray.

Nectarines.

This fruit is handled in a similar manner to the peach, requiring the same treatment. I have seen them peeled, but as they dry away considerably the practice is to dry without peeling.

Prunes.

In the prune-growing districts of California and Oregon the following varieties of plums have as yet been most extensively grown for converting into prunes by the process of drying, have been found to bear fairly well, and proven profitable, viz.:—Prune d'Agen or French prune, which is of medium size, with greenish-yellow flesh, full of sugar, rich, but clings slightly to the stone. Tree hardy and very productive.

Italian Prune.—This variety makes a good-sized prune, larger than the Prune d'Agen, but the tree is not quite so free a bearer. The dried fruit is of excellent quality, and is bluish-black in colour when dried, and freestone.

Silver Prune is a rich fruit, of good quality, but is inclined to be a shy bearer. It dries a light colour, and is one of the largest grown.

I have named the above three varieties, as in my experience they have produced the best crops of good, commercial fruit; there are, however, several other varieties which have done nearly as well, these being German Prune, Reine Claude de Bavay, Bulgarian and Giant.

Drying.

The fruit should not be picked until it is thoroughly ripe; then dip it in a solution consisting of 1 lb. of concentrated lye to 10 gallons of water, to be brought to the boil, and the fruit immersed from five to ten seconds, according to the toughness of the skin, or just long enough to slightly crack the skins. The fruit, which should be placed in wire or perforated metal baskets, should be dipped in the solution when it is just off the boil, and immediately after immersed in fresh, cold water, so as to rinse it. It should then be spread on trays,

and in the case of Silver or light-coloured prunes, should be put into the fumigator just long enough to set the colour well. After this the prunes are placed in the sun or evaporator (as the case may be). In the latter event the temperature should be about 130 degrees to start, and increased to 170 degrees or 180 degrees, this usually covering from one to two days, according to the size of the fruit. The fruit when done should be pliable; and when removed from the evaporator should be allowed to lie in sweat-boxes for a fortnight, so as to even up; then graded and neatly packed in boxes lined with white paper.

There is a machine which is used to prick the skins in place of dipping, which some people claim does equally good work, if not better; others use a combined dipper and pricker.

The length of time required for drying the different varieties in the evaporator varies according to size. The smallest are sometimes dried in less than a day, while the largest take two days.

The fruit should be properly graded before being packed, and classed as follows:—20 to 30's, 30 to 40's, 40 to 50's, &c., up to 120.

Lye-Dipping and Pricking of the Prune.

In a recent pamphlet published by the Agricultural Experimental Station, Berkeley, California, Mr. F. T. Bioletti reports as follows:—

The difference of opinion regarding the relative value of these two processes is so marked, practical men who have investigated and even tried both methods are so diametrically opposed in their views on the subject, that *a priori* there would seem to be but one explanation, viz., that it is largely a matter of taste. As a matter of fact, each process has produced dried prunes of excellent quality, which proves that if the conditions are right either process will produce good results.

The advocates of lye-dipping claim:

1. That the prunes are more thoroughly cleansed;
2. That they dry more quickly;
3. That the skin is rendered less tough;
4. That the finished product is of better appearance;
5. That the flavour is better.

On the other hand, the advocates of pricking claim:

1. That the hot water they use cleans the fruit perfectly;
2. That the prunes dry more evenly;
3. That no frogs are produced;
4. That the finished product is of better appearance;
5. That the flavour is better.

With certain reservations and explanations it may be said that all the claims of each side are true. With some pricking machines the washing is not very thorough, but with the best arrangements the cleaning is quite satisfactory. The lye-dipped prunes dry, according to the weather, in from two to seven days' less time than the pricked prunes. But the greater uniformity in the drying of the pricked fruit probably quite offsets this, especially where there are many tough-skinned prunes which the lye does not affect.

The third claim of the advocates of lye-dipping, that the skin is rendered less tough, hardly cuts any figure, as the lye acts only on those prunes which have naturally a tender skin, and leaves the tough-skinned ones untouched. It is with regard to the fourth claim, that is, with regard to the appearance of the fruit, that there is most to be said on both sides. All that the unbiassed observer can remark is that the finely wrinkled skin and light amber colour of the lye-dipped prunes are very attractive to those whom they attract, while the same remark applies to the smooth, shiny skin and black colour of the pricked prunes. As it is a matter of the consumer's taste, the market should quickly settle this question. It may be added that the smooth skin and black colour are characteristic of the best French dessert prunes, dried without either lye-dipping or pricking; and as habit is so powerful in matters of taste, this fact will certainly have influence. With regard to flavour my own impression is that the difference is so slight as to be scarcely noticeable, and to be quite obscured by the least diversity in the original quality of the fruit.

The conclusion, therefore, would seem to be that if we are dealing with good raw material, that is, fine, well-ripened prunes and good drying weather, the choice of method must depend on which appearance is most attractive to the average consumer.

There are, however, other cases to be considered. In the case of unevenly developed, mixed lots of fruit the pricking process affords more security against the frogging of a portion of the fruit, and the product is much more uniform in appearance and in time of drying. Uniformity in time of drying is very important, as the difficult and expensive hand-sorting on the drying-trays is thus reduced to a minimum. The mere pricking of a needle-hole evidently facilitates drying but very little; the exuding juice almost immediately closes up these fine holes. It is otherwise with the slits, which, being similar to the effect produced by the lye process, facilitate drying much more. Still the flow of sap consequent on the penetration of the needles into the flesh tends to close up the finer slits also, and thus retards drying, while, however, imparting to the surface that shining appearance which the lye-dipped prunes only obtain by an after-treatment.

It thus appears as though both processes had their place in the prune-drying industry, each serving best under special conditions; and that the smaller sizes especially would, on the whole, be more advantageously treated by the pricking than the lye-dipping process.

Figs.

The fig is only fit for drying when it is dead ripe, as if dried when only partially ripe the fruit will be found worthless, and possessing none of the rich flavour which characterises the well-developed and ripe fruit. The varieties which have been found to bear fairly well, and make a very good dried fruit, are the White Adriatic and White Genoa, the former, I consider, being the better of the two.

The Smyrna fig, as grown in Smyrna, makes the best dried article; but as yet they have not been successfully grown here, as in no instance have I seen the fruit mature.

When the figs are picked they are placed on trays, with the bloom end down, and exposed to the sun for two or three days, when they should be turned. If picked when properly ripe, it should not take longer than five days of our ordinary summer weather to dry the fruit; but they must not be allowed to get at all hard, being taken up while quite pliable. After the figs are dried it is well to place them in a tight box, with a weight on the top, to press them firmly together. By this means they will even up, all being brought to a uniform degree of dryness. In a week's time they are ready for packing; but before packing the fruit should be dipped into a weak brine, which not only assists crystallisation, but also adds to its appearance. In packing, the figs should be well worked out between the thumb and finger, and packed in boxes or drums holding from 1 lb. to 28 lb. I have improved the appearance of figs by the use of a little sulphur; but as I have seen so many dried figs practically ruined by over-sulphuring, I would not recommend its general use; but if practised the following rule for sulphuring should be adhered to, viz.:—The figs to be exposed to the sulphur fumes just long enough to set the colour, figs which are not quite ripe requiring a longer exposure than fully ripe ones. Half an hour should be quite long enough for any.

Apples.

With the exception of some of the very juicy apples, nearly all of these will make a marketable fruit, although the most suitable are the larger cooking varieties, with firm white flesh. It is necessary to have

a good machine, which will peel, core, and slice at the same time. The fruit is then placed on trays (wooden ones being largely used for this purpose in America, as it is claimed by many that the galvanised wire slightly damages the fruit during the process of sulphuring and drying; however, as yet this is a disputed question), and subjected to sulphur fumes just long enough to set the fruit a nice light colour. Great care must be exercised in the sulphuring, as if the fruit is left too long it becomes strongly flavoured with the sulphur, and consequently of very little value. Also, it must not be allowed to stand any length of time before being placed in the sulphur-room, as it discolours rapidly. After being bleached, the fruit is placed in the evaporator, and allowed to remain there until perfectly dry—that is, from six to eight hours exposed to a temperature ranging from 140 degrees to 160 degrees. Care must be taken not to allow the fruit to burn or bake, as it would in either case harden as soon as exposed to the air. It is then put into sweat-boxes, and allowed to stand for a few days, so as to even up the whole. Care must now be taken to keep the dried fruit away from the moths, otherwise they will get in and deposit their eggs, and the fruit will be spoilt. If the fruit is to be kept for some time before packing, it is always best to keep it in calico bags, securely tied.

Pears.

This fruit can be treated in every way similarly to the apple.

Raisin Grapes.

It will be found that the best raisin grapes are grown on the lighter and richer soils, and I have never yet in the colonies seen a first-class raisin made from grapes grown on a stiff soil.

To make a good table raisin, the grape must be grown to perfection —that is, the grape when ripe should be large, thin-skinned, fleshy, and containing plenty of sugar, and the bunches must be well filled, the larger the cluster the better the appearance of the fruit will be.

For making either pudding or table raisins, be sure that the fruit is perfectly ripe before picking, as for the latter purpose an under-ripe grape, when exposed to the sun, will turn red (in most cases), and will also take longer to dry than a ripe one, and when dried will be a sour and inferior raisin. My experience with regard to picking is that, in nine cases out of ten, the inexperienced fruit-grower imagines that as soon as his fruit is sweet enough to eat, the grapes are ready to pick for raisin-making, and, contrary to all advice, will start picking, only to find at the end of the first week that the grapes are not turning a good colour. He then decides to stop picking (if, indeed, it is not too late, and the grapes all picked) for a fortnight, so as to allow his fruit to become thoroughly ripe.

The only grapes which have so far produced a good commercial raisin in Australia are the Gordo Blanco and the Muscat of Alexandria. I have had samples of raisins sent to me made from other kinds of grapes, which did not present a bad appearance; but if the grower placed these on the market to compete with the raisins made from the

Gordo and Muscat, he would find that they would not sell so long as the latter were obtainable.

The process of curing the table raisin is as follows :—Pick the very best clusters—that is, only such as are well filled with large, fine grapes—cut out all damaged or hard grapes, and lay the bunches carefully on the trays, which are then placed in the sun. By the end of one week one side should be fairly well dried, and the bunches should now be turned. This turning is accomplished by placing an empty tray on the top of the full one. Two men can then take hold of the sides and invert the two, thus exposing to the sun the side of the fruit which had been lying next to the tray. After this turning it usually requires another week to finish the drying process, if the weather is favourable—that is, dry, warm days and nights. It usually takes from two to three weeks, under favourable circumstances, to cure good layer raisins; but if the weather is damp or threatening, it is better to stack up the trays at night, covering the stacks up with empty trays. If a table raisin gets wet during the curing process it darkens the stem and spoils the bloom, and thus lowers the grade and value of the fruit. I do not consider that it will ever pay to cure table raisins in the evaporator, as they require to be dried slowly, and when exposed to a temperature, while drying out of doors, of more than 96 degrees, they will burn, and thus spoil the sample. I do not consider they could stand more than 110 degrees in the evaporator, and I doubt if the green fruit could stand even this temperature without it having a damaging effect. Therefore, I would not recommend growing grapes for raisins in a climate where the evaporator would have to be resorted to.

Pudding Raisins or Lexias.

Grapes intended for this purpose should also be picked when fully ripe. All partially ripe and dried fruit should be removed, and the grapes then immersed for about three seconds in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water, and this *must* be kept just under the boil, as the dip will lose its effect if the lye is only fairly hot, and the fruit, instead of turning out a nice golden colour, would be brown. This, however, is not always the cause of the raisins being brown in colour, as it is impossible to make a good, bright Lexia, or good quality of raisin of any sort, from grapes grown on some of the heavier or stiffer soils. After the dipping process, it usually takes from five to eight days for the fruit to dry, this depending on the weather. About the fourth day after dipping, the grapes should be turned; but do not allow the fruit to become too dry before taking it in, a nice, pliable fruit being always the best. If there is any uncertainty as to whether the fruit is sufficiently dry or not, it can be tested by squeezing a few of the raisins between the thumb and finger, and if no moisture exudes, then the fruit is quite dry enough. The Lexias should be stemmed and graded as soon as possible after they are dry enough to remove from the tray to the sweat-box, as, if allowed to stand any length of time, the stem becomes toughened, and hard to separate from the raisin.

Curing Sultanas.

My advice to those growers of sultanas who have never yet dried any, is to this effect: When you think the fruit is ripe enough to pick, leave it for at least another fortnight, as, when they are quite sweet and fit to eat, they are not by any means fit to dry. When they are a clear, amber colour, and perfectly sweet, without a trace of acidity in any of the berries, they should be about ready to pick. The last fortnight, before the fruit has attained this stage, adds considerable sugar, which means increased weight and a better quality of dried fruit—consequently it is best to pick when it is dead ripe, and dip as soon after as possible in a lye made in the proportion of 1 lb. of caustic soda to 8 gallons of water. The fruit must be dipped while the lye is just under the boil, but must not be immersed for longer than two seconds, after which the grapes are spread thinly on the ordinary drying trays, and exposed to the sun for a day or two. The fruit should always be turned the day after dipping, which latter process is described under Table Raisins. If the nights are cool, or rain threatens, the trays should be stacked up, and the stacks covered with empty trays, so that the fruit cannot be damaged. If the weather is very hot, the trays may be stacked up and allowed to remain thus until the sultanas are dry. Never expose sultanas to too great a heat, or the colour will not be good; and it is essential, if the grower desires to get the best prices for his fruit, to make a good, light-coloured article.

Zante Currant Curing.

The Zante currant is very easily cured. Allow the fruit to hang until thoroughly ripe—that is, until some of the currants begin to shrivel on the bunches, then pick and place on trays, but do not fill these too full, or the fruit will roll off. Expose to the sun for four or five days, when they should be dry enough to put in bags. Care must be taken with this fruit, as, if exposed too long, the moths will infest it, so that I strongly recommend bagging it until the fruit is stemmed and properly packed.

Dipping-Trays.

These are made of heavy galvanised wire-netting, ¼-inch mesh, to be nailed on a frame 2 feet wide by 3 feet long and 4 inches high, and not less than an inch in thickness, one end of the tray to be left open for convenience in sliding the fruit from the dipping to the drying trays. This end, however, must be strengthened with a piece of ⅜-inch by 1-inch iron across this end and screwed to the side-pieces. Two handles to be joined to the sides of the tray—one at either end, and so made that when the tray is being filled the handles will just drop down over the end of the tray, and thus not interfere with the filling.

Fumigating and Sulphuring.

The fumigator should be built handy to the cutting-sheds and drying-ground. It should be large enough for the requirements of the orchard, but I would not recommend building a room so small that it would not hold at least a hundred trays—that is, unless the grower has only a few trees, when almost any fairly air-tight box capable of holding a dozen trays would answer the purpose.

A good-sized room for an ordinary orchardist is one 9 feet by 10 feet and 6 feet 6 inches high on the inside, built of tongued and grooved boards, and put together with white lead. Any small cracks can be filled up with putty, and if the room should be found to leak, it can be papered inside. Fruit sulphured in a large room rarely ever tastes of the sulphur, and this is the great advantage of having a good-sized room, even though it takes a little more sulphur. A room such as this will hold 300 trays quite easily, and requires about 2 lb. of sulphur.

If the orchardist has only a small quantity of fruit to handle this could be sulphured by taking a good-sized packing-case capable of holding a dozen trays; paper it inside, and having stacked the trays one on top of another, place the box over the top of the whole. This should be placed partly over a hole in the ground, previously dug for the purpose, and from 2 feet 6 inches to 3 feet deep, wherein the sulphur is to be burnt in a small iron pot. When the sulphur is lit, cover the hole closely on the outside with a piece of iron or board, so that the fumes cannot escape.

Drying-trays.

These are made with either three or four boards. I prefer the three boards, as there are not so many cracks, which is an advantage in curing small fruits such as sultanas, currants, &c., and they appear to hold together better. I am speaking from experience, as I have been accustomed to using twenty thousand at a time on which to cure raisins in California, and as many in drying apricots. The same class of tray was used in Mildura, where we also handled fully as many.

A good tray is made as follows:—The ends or cleats are made $2\frac{1}{4}$ inches wide and $\frac{7}{8}$ inch thick; the three boards $\frac{1}{2}$-inch thick are then nailed securely on these cleats by driving four nails in each end—nails to be 2-inch round wire nails with flat heads. Such a tray as this is useful for any fruit drying in the sun, and can also be used for storing lemons and oranges by placing in sweat-boxes with a layer of fruit on each.

In drying fruit, these trays, when necessary, can easily be stacked one on top of the other, and the stack covered with two empty trays to keep the rain off.

These trays should not cost more than 6d. or 7d. each by the thousand in Sydney.

Drying-ground.

It was thought at one time that a lucerne paddock would make an excellent drying-ground, and so it does, but the fruit dries more slowly than it does on the dry ground, and it has been found that the moths are much more troublesome, so that of late years the lucerne has been abandoned, and any clean unbroken ground used instead. This, of course, has its disadvantages, as the dust rises easily, and great care should be taken to keep the ground sprinkled wherever it has to be walked over. By taking this precaution the fruit can be kept quite clean, and it dries more quickly than when the trays are spread on lucerne.

In spreading the trays do not leave roadways between them, but place them side by side, so that the whole ground is covered, and thus there are only the outside trays to watch. This applies to the stone-fruits more particularly. In placing raisins out to dry it is necessary to place the trays so that the fruit can easily be turned, therefore in this case it is necessary to leave a narrow roadway between the rows of trays.

List of Blight-proof Apples.

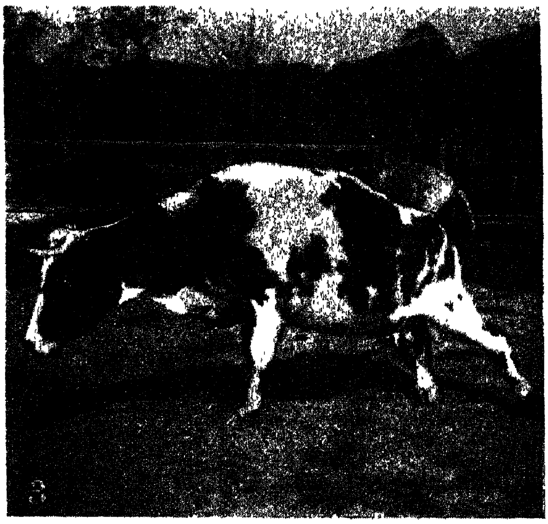
In response to the request of Mr. W. J. Allen, Fruit Expert, the following particulars have been furnished with respect to apples which have been found to be free from blight (woolly aphis) in the districts named.

As other lists are received they will be published, and eventually it is hoped to be possible to issue a complete and reliable list of trees that can be recommended for different districts.

Mr. J. F. Chaffey, of Glen Innes:—"I have found an apple, purchased as the 'Cornish Gilliflower,' perfectly blight-proof with me. In fact, it is free from all pests, although other varieties close by are badly affected. I also consider it the most profitable apple in the orchard. My trees are now 7 years old."

Mr. J. L. Kent, Young:—"The following list I have grown for a number of years—many of them for twenty-five years—and I have never seen any signs of blight on any of them, though grown with other apples that will blight, and many of them worked on seedling stocks:—

Peach Apple.
Jupp's Surprise.
Devonshire Qarrenden.
Scot's Redstreak.
Red Caldwell.
Caldwell's Keeper.
Glade's Redstreak.
Shepherd's Perfection.
Lord Wolsley.
Billy's Seedling.
Five-crown Pippin.
Frampton.
Winter Pearmain.
Winter Majetin.
Northern Spy.
Kentish Fillbasket.
Webb's Russet."



g. 1.—The Burrawang showing evidence of having been eaten by cattle. Fig. 2.—A heifer in the first stage of the disease. Fig. 3.—An aged cow in an advanced stage of the disease, trailing hind legs behind her. The two animals in the background are also affected. Fig. 4.—A cow in the advanced stage about to knuckle over at hind fetlocks on being turned round sharply.

A Report on the Disease affecting Cattle in the Moruya District.

By J. D. STEWART,
Veterinary Surgeon to Stock Department, New South Wales.

In compliance with instructions, I left Sydney for Moruya on 2nd September, 1899, to conduct an inquiry into the disease affecting cattle in that district, and remained there several days. On arriving at Tarago I was met by Mr. Inspector of Stock H. L. Mater, who kindly drove me from there to Moruya and back, a distance of about 160 miles, and who also rendered valuable assistance during the conduction of investigations.

The disease, which is known locally as "rickets," or "ricketty," was first noticed about fifteen months ago, when it affected a few head of cattle belonging to one owner. Since then it has become more prevalent. About 100 head of cattle, belonging to several owners, and occupying different paddocks, have manifested symptoms. The disease affects cattle of all sexes from 6 months old upwards. It is very prevalent among yearlings.

Symptoms.

The disease apparently affects the posterior portion of the trunk, or the hind extremities only.

Attention is first directed to the presence of the disease by a peculiar arching of the back the affected animals acquire, and a certain weakness in movement of the hind-quarters. The affected animal is often noticed to stand with its back prominently arched and void small quantities of urine. In a few days time the weakness in the hind-quarters becomes more pronounced, so that these parts sway from side to side when the animal walks.

When the disease is thoroughly established a wasting of the muscles over the region of the loins and of the hind-quarters becomes apparent. The arching of the back is consequently rendered more evident. Otherwise, when the affected animals are standing quietly, little can be detected but what might be fairly attributed to the severeness of the seasons the cattle have passed through. Their appetite is good, and rumination perfect. The milk of affected cows, although diminished in quantity, does not appear to be altered in quality. The fæces are of normal colour and consistency, while the urine in colour is similar to that of healthy cattle, and its voiding does not produce any after-effects, such as scalding or straining. The pulse and temperature are about normal. The dilation of the pupils of the eyes does not seem to be interfered with, and the animals, even in severe cases, are quite sensitive to pin-stabs inflicted on the hind legs and quarters.

On being approached in the yards the cattle become excited, and endeavour to get away. As soon as they go into a fast walk the hind-quarters sway from side to side, and the hind legs are crossed in an erratic manner at each step. If the animal increases the pace from walk to a trot the want of co-ordination in the action of the muscles of the hind legs becomes very pronounced, the animal being unable to control the movements of these parts. Often one or both hind legs sink beneath the body weight, and are trailed behind; the animal's movements for the moment closely resemble those of a dog suffering from tick-poison. Again, if an affected beast endeavours to rush away the hind legs usually knuckle over at the fetlock joints, and the animal may travel some yards on the front of its hind fetlocks and hoofs by vigorously working with the unaffected forelegs. When the animals stop their rush or charge they regain their foothold, and stand on all fours in the natural way, being apparently but little exhausted or pained by their extraordinary method of locomotion. Sometimes a beast no sooner recovers its standing position than it endeavours to playfully charge a neighbouring animal, a procedure which invariably causes an exacerbation of the symptoms just described. During the struggles incontinence of urine is often observed.

As the disease becomes more severe the affected animals often fall during their struggles in locomotion.

An animal in the worst stage of the disease cannot move 10 yards without falling down, and is unable to rise without assistance. Such an animal, if not slaughtered, dies from exhaustion and starvation.

Between the mild and severe forms there are many gradations. In some cases it is necessary to drive the cattle down hill, and to turn them sharply to detect symptoms; in others, they cannot move without showing manifestations.

Post-mortem Appearances.

The following description is based on observations made during *post-mortem* examinations conducted on the three following cases, viz.:—

Case I.—A young steer, in low condition, said to have been affected for some months.

Case II.—An aged cow, in fair condition, said to have recently become affected.

Case III.—A young bull, also in fair condition, said to have manifested characteristic symptoms quite recently.

These animals were killed by pithing, and then bled. With the exception of a few lice about the base of the ears, no parasites were found attached to the skin; the blood was normal and coagulated perfectly. No discharges, effusions, or exudations were present. The flesh, fat, and lymphatic glands were apparently normal, as were also the heart, lungs, and spleen. The liver was slightly cirrhotic owing to the presence of a few fluke. The kidneys in two cases were normal, but those of No. III were pale. The bladder was normal, and contained

about a pint of urine of normal appearance. The first stomach was well filled with ingesta composed of grasses, mixed with which leaves and stalks of the burrawang were found. The second and third stomachs were normal, but the mucous membrane of the fourth (the abomasum) showed patchy areas of inflammation, especially about the pyloric orifice. The intestines and their contents were apparently unaltered. The brain, spinal cord, and the nerve-trunks of the hind extremities were apparently normal. The articular cartilages of the hock and fetlock joints of the hind legs showed erosions. These lesions are regarded as sequelæ.

In case II a sero-sanquinolent extravasation was found about the great sciatic nerve of the left side. This cow had fallen down and when found was unable to rise without assistance. It is probable that the extravasation was the result of a bruise.

The local appellation of rickets—a term applied to a bone disease—is a misnomer, and should not be used.

The symptoms above described indicate the existence of partial motor paralysis of the hind extremities due to loss of nervous control over the actions of the muscles of the affected parts. Such conditions are usually attributable to the action of poisons, specific or other. As far as concerns specific poisons, I have collected specimens enumerated in Appendix for microscopical and chemical examination. These have have been forwarded to the Health Department.

Turning my attention to the question of poisons of non-specific nature, inquiries were made as to the conditions under which the animals were kept and as to their management. I found the country about Moruya consists of alluvial flats lining the river banks, surrounded by ridges of granite formation. The prevalent timbers are apple-tree, wattle, box, peppermint, blackbutt, stringybark, and several other kinds of gum-trees. The couch and kangaroo varieties of grasses are common in the cleared paddocks, while ferns and burrawang abound on the ridges.

For over a year previous to the recent rains, which brought about a fair shoot in the grass, the period is characterised by the residents as one prolonged and unprecedented drought. As the conditions of drought became severely felt, and grass on the river flats became scarce, owners were compelled to turn some of their cattle out on to the ridges to get what living they best could. All the cattle in the district became low in condition, but the disease has only affected a certain number of those which inhabited the ridges. On inspecting these places there was found unmistakable evidence of the cattle having eaten freely of the burrawang, while the ferns remained untouched. The young burrawangs were eaten down, the medium-sized ones stripped of their leaves, while only the end of the leaves of the full-grown plants have been nibbled at.

As mentioned in the *post mortem* appearances, portions of the leaves and stalks of these plants were found in the rumen (or first stomach) of the cattle subjected to examination.

No doubt the majority of the animals were compelled to eat the burrawang owing to the scarcity of other food. Still, hunger and

mal-nutrition cannot be accepted as more than predisposing causes to the disease, as often the best conditioned animal in the herd has manifested symptoms. Moreover, many cattle were not affected some six months ago, when they were decidedly poor, but have succumbed recently when they were thriving.

As far as could be ascertained, all the affected cattle have had an opportunity of eating burrawang. On the other hand, the disease has not been known to affect cattle that have been permanently depastured in paddocks where the plant is absent. In one instance the disease was stated to have affected some poddy calves, but on investigating it was ascertained that these animals, after receiving their daily allowance of milk or whey, were turned out on to some ridges, and were frequently seen by the attendant to nibble the leaves of the burrawang.

It is stated there are indications that once an animal commences to nibble at the zamia or burrawang it contracts the habit and becomes a "zamia-eater," and once the disease is properly established there is but little chance of recovery occurring.

The burrawang is a species of zamia which grows prolifically on the ridges surrounding Moruya. The poisonous effects of zamia upon cattle have been previously recorded. From a paper written by Mr. F. Turner, and published in the *Agricultural Gazette* (Vol. IV), the following extracts are taken:—"The plant known to botanists as *Macrozamia Miquelii* belongs to the natural order of *Cycadeæ*, under which are arranged in Australia three genera and about fourteen species, and also several varieties. As far as is known at present there are only about four species and five varieties found in New South Wales. The *Macrozamia spiralis*, or the burrawang, is a very common plant on the eastern side of the Dividing Ranges from Illawarra to the Tweed."

It is stated that Mr. W. Norton of Yeppoon, Queensland, produced characteristic symptoms in a two-year old heifer by feeding it on the leaves and fruit of the zamia.

Dr. T. L. Bancroft was commissioned by the Queensland Government to investigate the disease known as "Rickets" in cattle. He reported that the disease had been very prevalent for some years past in the central coast district of Queensland and Western Australia. The zamia grows in these regions, and the whole tenor of the report is in favour of the zamia as being the cause of the disease. Moreover, the symptoms, as described by him, agree with those manifested by the cattle at Moruya.

According to the late Baron Von Mueller, in the *Chemist and Druggist*, 1893, all the zamia are pervaded by a virulent poison principle. Some time ago Dr. Milford made an analysis, which was published in the Royal Society's proceedings for New South Wales, stating the nut of the zamia contains oxalic acid and an alkaloid.

The poison has never been satisfactorily isolated.

The pathology of this disease is unknown, but I believe Dr. Hunt, the Queensland Government Pathologist, is conducting research work in this direction.

Pending further scientific investigations any opinion formulated as to the cause of the disease must be more or less theoretical. Still, in our present knowledge, and in consequence of the intimate association the zamia or burrawang has with the presence of the disease, one is justified in regarding with grave suspicion the eating of these plants by cattle as being the cause of this disease by virtue of some toxic properties they contain.

In view of the above circumstances treatment must be more or less empirical, but the following course appears advisable, viz., as soon as the first symptoms are recognised the animal should be placed in a small enclosure (free from burrawang), and a purgative drench administered to it. After the effects of the physic have passed off the animal should be liberally fed and given an occasional ounce dose of potassium nitrate in the drinking water. In the case of animals whose value is sufficient to justify the expense of constant attention a course of treatment with nerve tonics, alternated with potassium iodide, is recommended after the administration of a purgative. In severe cases the effect of a strong blister applied over the loins and croup may be tried.

As a preventive measure, the eradication of the burrawang from the paddocks the cattle are depastured in is strongly advocated.

The stock-owners of Moruya are desirous of assisting the Government in any scientific investigation undertaken in connection with this disease.

APPENDIX.

THE following specimens were collected and forwarded to the Health Department for microscopical and chemical examination :—

From Case I.

(*a*) Portion of spinal cord from lumbar region.
(*b*) Portions of great sciatic nerves.

From Case II.

(*a*) The cerebellum, medulla O, and pons varolu.
(*b*) Spinal cord from lumbar and sacral regions, with main nerve-trunks attached.

From Case III.

(*a*) A mesenteric lymphatic gland.
(*b*) Poplitcal lymphatic gland.
(*c*) Portions of muscles of hind-quarters—semitendinosus and quadriceps extensor cruris.
(*d*) Urine.
(*e*) Ingesta from fourth stomach.
(*f*) Blood smears.
(*g*) Blood solution.

From an affected dairy cow a quantity of milk.

The leaves, branches, and seeds of the particular variety of burrawang the Moruya cattle ate were forwarded to Mr. J. H. Maiden, Director of the Botanical Gardens, for identification.

List of Expert Judges.

The Committee appointed by the Hon. the Minister for Mines and Agriculture have nominated the following gentlemen as competent to act as judges in the sections named. The list of nominations is not yet complete, but the whole of the names will be ready for publication next issue:—

Sheep.

Frank Loder, Deniliquin.
R. D. Gibb, West Berthong, Wallendbeen.
A. D. Wigan, Brae Springs, Jindera.
J. T. Edgar, Edenhope (Victoria).
W. Moodie, Wanda Vale (Victoria).
Robert Clarke, Bolinda Vale (Victoria).
Thos. Skene, Sebrof, Armadale (Vic.), B.B.
David Mott, Broxbourne, Pittsworth (Q.).
Edward Martin, grazier, Goulburn.
J. C. Darke, c/o. Bacon & Co., Gunnedah.
Norman Gibson, Inverell.
R. Rouse, junior, Biraganbil, Gulgong.
Hon. F. B. Suttor, Bradwardine, Bathurst.
J. J. Devereux, grazier, Cooma.
Hubert Parker, Deniliquin.
J. Fulton, Wonnamurra, Jerilderie.
W. W. Clark, Waverton, Cargo.
H. E. Martin, Glenwood, Spicer's Creek.
F. W. Hume, Larengo, Burrowa.
H. M. S. Cox, Rawden, Rylstone.
James Sloane, Mulwala, Albury.
C. Mills, Uardry, Hay.
W. B. Sanger, Wangamong, Corowa.
Charles Robinson, Bathurst.
H. L. Culley, Naranderra.
J. A. Wallace, Orange, B.B.
R. A. D. Hood, Merriang, Hexham (Vic.), B.B.
G. L. Lethbridge, Bridgman.
E. D. E. van Weenen, German Club, Sydney.

Sheep Dog Trials.

Neil McCallum, Murrulebale, Old Junee.
H. G. Thackery, Clifton, Young.
J. Fulton, Wonnamurra, Jerilderie.
E. D. E. van Weenen, German Club, Sydney.
W. B. Sanger, Wangamong, Corowa.
Charles Robinson, Bathurst.
V. J. Dowling, Lue, Mudgee.
J. Dulhunty, Dubbo.
R. Rouse, junior, Biraganbil, Gulgong.
R. B. MacMartin, Tyrie, Dandaloo.
A. Carson, Goangra, Walgett.
Hon. F. B. Suttor, Bradwardine, Bathurst.
J. Sloane, Mulwala, Albury.
H. M. S. Cox, Rawdon, Rylstone.
G. L. Lethbridge, Bridgman.

Beef Cattle.

T. H. Griffiths, Albury.
A. A. Dangar, Baroonah, Whittingham.
C. Baldwin, Durham Court.
T. F. Mackenzie, Bondi.
Geo. Loder, Abbey Green, Singleton.
S. Clift, West Maitland.
H. Dawson, Elizabeth-street.
F. S. Reynolds, Tocal.
C. F. Bayly, Ben Lomond.
J. Holmes, Bathurst.
J. A. Badgery, Sutton Forest.
T. Baird, Dubbo.
A. Cummings, Reid's Flat, Burrowa.
Geo. Williams, Tyreel, Moree.
J. Dill, Toogimbie, Hay.
W. Onus, Inverell.
Thos. Brown, Kiama.
J. D. Cox, Cullenbone, Mudgee.
Andrew Badgery, Sutton Forest.
Robert McIntyre.

Draught Horses.

James Shannon, Tumberumba.
S. Irving, Moss Vale.
J, Dawson, Menangle.
Joseph Corby, Cootamundra.
W. W. Priddle, Grenfell.
John Cameron, Moree.
Timothy Raey, Richmond.
Edwin White, Inverell.
M. Hindmarsh, Kiama.
Isaac Bates, Molong.
Richard Rouse, Gulgong.
J. D. Single, Penrith.
John Hynes, Drake.
Geo. Robson, Dungog.
W. Fisher, Coolaman.
J. J. Sullivan, Bathurst.
James Holmes, Bathurst.
John Fagan, Mundurama.
C. J. McCaffrey, Woolloomooloo.
A. H. Dawes, Singleton.

Miscellaneous Horses.

J. C. Donnelly, Borambola, Wagga.
E. R. White, Merton, Denman.
J. Campbell, Carnira, Casino.
R. Rouse, jun., Biraganbil, Gulgong.

MISCELLANEOUS HORSES—*continued.*

J. F. Small, Kempsey.
H. M. Somer, *Sydney Mail* Office.
John Love, Kiama.
H. L. McDougall, West Maitland.
Percy Reynolds, Clydesdale, Riverstone.
J. B. Clift, Breeza.
S. E. Lowe, Wilbertree, Mudgee.
H. R. Murray, Moree.
W. Donohoe, Bombah, Warren.
E. Harvey, Crookwell.
J. Grant, Belubula, Canowindra.
F. C. Piggin, Corowa.
R. H. Inglis, The Oaks, Camden.
John Dunstan, Rosedale, Kurrajong.
C. G. MacMahon, Wentworth.
Stephen Dunstan, Richmond.

FARM PRODUCE.

James Hayter, Newrybar.
George Death, Blayney.
Geo. Crispin, Grafton.
W. H. Matthews, Cootamundra.
John Weatherspoon, Glen Innes.
Bernard Conlan, Windsor.
R. Aberdeen, Shoalhaven.
Geo. Hawke, Orange.
J. T. Hayter, Robertson.
Geo. Wells, Sydney.
Jas. Stephenson, Sydney.
T. C. Worboys, Springhill.
Geo. Clout, Bungle.
Alexr. Davis, Gilmore.
D. Scott, Condobolin.
W. C. Robinson, Sussex-street, Sydney.
J. McClure, Sussex-street, Sydney.
John Blackwell, Sussex-street, Sydney.
Isaac Whereat, Tenterfield.
J. L. Thompson, Enfield.

FRUIT.

John Hayes, Bulga.
R. Scobie, West Maitland.
Fred. Young, Cumnock.
Aubrey Griffiths, Darling Harbour, Sydney.
John Pope, York-street, Sydney.
Matthew Waddel, Singleton.
George Walker, Emu Plains.
W. J. Allen, Department of Agriculture, Sydney.
Alex. Hendry, Broken Hill.
A. Manson, Goulburn.
W. Running, Surrey Park, Stonehenge.
W. Tomlin, Berry.
S. Whitehead, Taree.
W. Binsby, J.P., Crookwell.
James Purser, Castle Hill.
A. Hunter, Gosford.
Percy Douglas, Sydney.
R. Herrod, Victoria Markets, Sydney.
John Robertson, Cowra.
W. H. McKeown, Belmore Markets, Sydney.
T. Miller, Tenterfield.

IMPLEMENTS AND MACHINERY.

C. J. Morton, Albury.
Joseph Corby, Cootamundra.
A. Chant, Young.
A. Brunskill, Wagga.
J. S. Taylor, Junee.
Hugh Fish, Bathurst.
Jas. Cox, Eglinton, Bathurst.
Jas. McCann, Orange.
Samuel Page, Melrose, Mudgee.
G. F. Bennett, St. Mary's.
Geo. Nicholas, Wilberforce.
Geo. Howitt, West Maitland.
J. Johns, Quirindi.
J. Gordon, Inverell.
W. Hutchinson, Glen Innes.
William Jones, Grenfell.
David Gordon, Coonamble.
J. J. Chaffey, Glen Innes.
J. McLean, Cobborah Road, Dubbo.
W. Mitchell, Richmond.

PIGS.

C. J. Morton, Jindera.
Henry Hicks, Shellharbour.
Owen Daley, Alstonville.
J. P. Ryan, junior, Bathurst.
William Murray, Bowral.
James Knox, Berry.
O. Flannagan, Dubbo.
W. K. Gibbons, Carlingford.
H. L. McDougall, West Maitland.
John Elliot, Lismore.
Robert Thomas, Parkes.
W. F. Penny, Sydney.
E. M. Betts, Gladesville.
T. H. York, Wellington.
Thomas Coxon, Moruya.
S. P. Reynolds, Cumnock.
John Elliot, Bingalow.
Edward Jamieson, Mogilla.
Joseph Petty, Milton.
J. L. Thompson, Enfield.

POULTRY.

W. H. Webb, Bathurst.
W. C. Forster, North Botany.
S. Kernside, Centennial-st., Marrickville.
W. Hope, Oxford-street.
L. L. Ramsay, 58, Pitt-street.
J. E. Pemell, Randwick.
C. Brown, Newbridge.
H. Cadell, Beecroft.
A. T. Compton, Balmain-road, Leichhardt.
R. H. Judd, St. Peters.
S. R. Watkins, Toongabbie.
S. Francis, Rockdale.
O. Wilson, Mount Druitt.
A. T. Lurcock, North Parramatta.
G. Bradshaw, Board for Exports, Sydney.
A. J. Gray, 92, Pitt-street, Sydney.
R. Baldwin, Lands Department.
W. M'Kay, c/o E. Butcher, 126, Pitt-st.
D. S. Thompson, Peralba.
W. W. Smith, Liverpool.

Soil Exhaustion.

By J. L. THOMPSON,
Travelling Agricultural Instructor.

An article on the above subject recently appeared in the *Pacific Bee.* I have taken the liberty of making alterations and additions, so to make it pertinent to the wheat-growing areas of this Colony, as well as other parts of Australia.

All branches of agriculture in Australia will have greatly advanced when the farmer shall have learned to treat the soil as he would a bank account. No one expects to draw money from a bank continually without paying in anything, for the time would come when the cashier would write across the face of a cheque "No Funds," and it would be returned to the drawer dishonored. And yet it is just as unreasonable to expect the soil to keep on, year after year, satisfying the heavy drafts that the farmer makes upon it. There is this difference, however, between the soil and a bank: The bank gives no notice of the progressive exhaustion of the deposit. So long as a cheque or draft does not exceed the amount of the credit, the cashier pays it without a word of warning. It is not his business to caution the depositor. The soil, on the other hand, warns the cultivator of its gradual exhaustion by a decline in the yield. The warning of fertility is plainly shown in the partial failure of crops. In the older wheat-growing areas this lesson is given on the lands long tilled, but still the resort to fertilising is generally postponed. This is largely because the Australian farmer rarely looks upon his land as a heritage to be transmitted to his children undiminished in fertility and productiveness. The farm in many parts of Australia is not commonly regarded as a permanent home for the family and its descendants, as is done in the old country, but merely as land to be worked for all that can be got out of it, leaving posterity to shift for itself.

This view may be justified from the fact that posterity has done nothing for us. It certainly does appear that Australian posterity, at least in the abstract, will be left to "hustle" so far as this problem of fertilisation is concerned. A very little calculation would show that at the prevailing prices for wheat there would be little or no profit in growing it, if the fertility it takes from the soil were to be restored by manuring in any form. So little live stock is kept on our wheat farms that the purchase of commercial fertilisers would be the only means of restoring the plant-food taken away by the crops.

The cost of such fertilisers is regarded as practically prohibitory, so far as grain-raising is concerned, and so the present exhausting system continues.

The prospect, of course, is rough for the future, but the present attitude in this regard is virtually "let the future take care of itself." There are, however, many comparatively young farmers who will be compelled by the poverty or failure of crops to grapple for themselves with this question of fertilising, for it is one that cannot be put down. It is mere folly to ignore the fact of decline of fertility and pure ignorance to insist that the full productiveness of soil can be kept up without replacing the costly phosphoric acid, potash, and nitrogen that are taken away by the crops. The lesson of the situation is for the farmers to turn their attention to other crops than wheat, and to practise some system of rotation. Much improvement may be brought about by dairy-farming in suitable districts with or without irrigation, but no great change is to be looked for until, in one way or another, the large farms are subdivided, and small farming becomes general, rather than the exception. The subject has many aspects, and is entirely too comprehensive to be discussed adequately in a short article.

Brief Report on Locust-Fungus Imported from the Cape.

By D. McAlpine.

Although there has been a deal written in various journals about the so-called locust-fungus, I am not aware that any one has definitely determined what it is. In importing it into Victoria, it is desirable to know something of its nature before scattering it broadcast, and what probability there is of its serving the purpose for which it was intended. I need not dwell here upon what is well known, that various fungi may be used effectively against insect pests; but it does not necessarily follow that such fungi will act similarly under different conditions of climate, and so it becomes necessary to test their efficacy under new conditions.

I have examined cultures of this fungus on gelatine, obtained direct from the Cape, and also from cultures made by Dr. Bull, at the University Bacteriological Laboratory. The fungus is a mould not at all uncommon in Europe or America, and known scientifically as *Mucor racemosus*, Fres.

It is usually found on decaying substances containing starch, and Wehmer has determined it to be the cause of a ripe-rot in plums, but it has not hitherto been found as an insect destroyer except at the Cape.

The Director of the Bacteriological Institute at the Cape has just written to me as follows :—

> I may mention that many thousands of tubes have been used in this Colony with unfailing success in *wet* weather, if properly applied. In *dry* weather the fungus is not so certain in its results; but even then it has been extremely satisfactory in the hands of the locust experts sent out by the Government, who are practised in its use. The fungus has been despatched to Cyprus, Algeria, Palestine, South America, and many other parts of the world.

As there is abundance of the fungus, and Dr. Bull informs me that it can be easily multiplied, its effect upon locusts in a small way will be tested immediately, and the results forwarded as early as possible.

Bee Calendar.

ALBERT GALE.

November.

From last month to the end of this has been and is the most important part of the year to bee-keepers, as regards the increase of colonies. Localities for the swarming of bees differ greatly in this country. Our climate is almost from the frigid to the torrid zones. This, of necessity, must have a very great influence on the reproductive powers of bees, dependent as they are on the flowering seasons of the year. From the most northern portions of our coastal districts to the most southerly, the growth of summer is so gradual that the merging of one season into the other is imperceptible. So is the opening of the spring flowers, and so also the swarming of bees. As the swarming season extends along the coast southwards, it gradually creeps up the more elevated tablelands. Perhaps the western slopes of the Great Dividing Range, that are well sheltered from the sea breeze, have a swarming advantage over the coastal district.

So far this season has been very favourable to the bee-keeper. The wet winter, followed by a seasonable spring, has given a blooming impulse to the fruit-trees. This gives plenty of honey for the early spring swarming. Where it is not desirable to extend the number of colonies, be satisfied with the first swarm and that only. Check all after swarms. Your stocks will be more content after they have cast off the first spring swarm and go in more for storing for winter use. Examine for queen cells if swarms are not required and remove them. Note the young bees that are on the wing, and if not up to the mark re-queen with the best tested queen to be obtained. There is nothing to be obtained by keeping a useless mother bee. In the warm districts bees will be in full swing for some weeks, and there should be no difficulty in obtaining good young tested queens to replace some of the older ones not up to date.

If you wish to keep colonies strong (if you do not do so there is not much chance of getting surplus honey), as soon as a swarm has alighted shake them in the usual way, and when they have fairly settled in the receiving-box place them in close proximity to the parent hive, select the better of the two queens—*i.e.*, if the young queen has emerged from the cell—and return the swarm to the hive from whence they came. The next morning the new swarm will set to work equal to a virgin colony. If you wish to make an alteration in position, or alter the locality of your hive, now is the time to do it. You can easily

remove the parent hive and the new occupants to any position or locality you may require. Not one per cent. of the old bees will return to the old site. It will make no difference if they are removed a mile or a foot, the result will be the same. They should be removed in the evening of the same day they issued forth.

See that there is sufficient room in the hive for increase of brood. Do not let new swarms hang out in the sun. When they are placed in the receiving-box, place them in a shady spot to keep them cool. See that all hives are well ventilated. There will be honey to extract. As far as possible, keep the various flavoured honeys separate; it will make a deal of difference in the commercial value of your returns.

Farmers and the Roads.

The following extracts from an article by a Florida farmer in one of the leading American journals seem to be worthy of consideration:—

It is easily possible for farmers to keep country roads in a much better condition than most of them are at present. The individual can afford to do road mending on the same principle that he repairs fences and buildings: "It pays me;" and a landowner ought to feel as much shame, even guilt, before the general public over a mud-hole that can be drained, or over a choked-up sluice along his premises, as he ought over neglected cattle or a display of filth.

It is not necessary to wait for the road-working season to come. The most profitable, common-sense work can be put in a little at a time, if at the right time. Drainage is the beginning and the ending of the whole matter, if roads are to be roads and not sloughs. Watering-troughs and hillside springs are common causes of standing water, yet it is a very simple matter to direct the water flowing from them in the way it should go. A stone, a loose board, a chunk of soil washed down against the end of a sluice, may choke it up till it is worse than nothing. Five minutes' work would send the water rushing through its proper channel. It is not uncommon to see water following the wheel rut for rods, when a man with half an eye can also see that a mere cut through the ridge at the edge of the road would lead the water into the ditch—perhaps down a bank.

Dropping into a bad hole or soft place a few superfluous stones now and then to keep the water out would work a double-headed blessing to all passing that way. Heaving out a few stubborn old stones from the track would work detriment to the blacksmith and waggon-maker perhaps, but a big saving to the farmer. If all such patching were thus well kept up, the yearly toll of public service would count more and more toward the good roads of which all are dreaming and talking. This view of the subject is no more than one feature of practical farming, intelligent economy, a mere looking out for number one, no matter how many others are also benefited.

Farm Notes.

NORTHERN RIVERS DISTRICT—November.

H. V. JACKSON.

It is perhaps as well to note for future guidance next season that frosts occurred at Wollongbar up to the 4th of October. After considerable rain and mild weather tending to bring forward young growth of plants, a severe fall of temperature was experienced on the 2nd October with considerable frost, especially on the lower lands, killing off young pumpkin-vines and blackening the nicely grown potato-tops.

If weather is favourable, now is a good time for sowing sorghum. Land that has borne a crop of oats or other cereal previously may be ploughed and got ready for the purpose. Sorghum, Amber cane, Planter's Friend, and green maize, also teosinte makes excellent silage.

Maize already planted should be coming on well, and seed may still be sown; also sow the large Russian sunflower for mixing with other stuff for silage, and likewise the seeds for fowl food. Sow it in drills 3 feet apart.

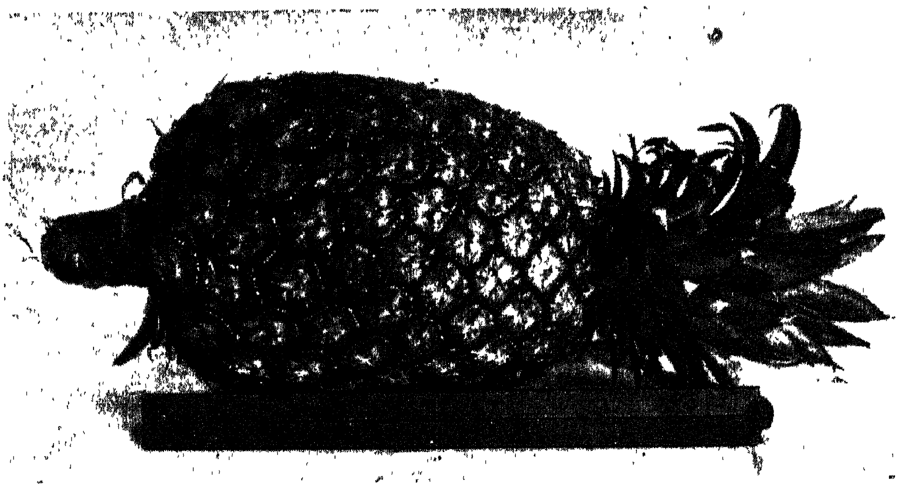
Hungarian millet may also be sown for green crop. Sow cow-peas for green manuring, and buckwheat for fowl food and for bees.

See that onions are thinned and kept free from weeds.

Pumpkins and melons may be sown, and those already coming on should be kept clean, and may require lime dusting if the pumpkin-beetles are troublesome. Air-slaked lime should be used; some people people use tobacco dust, others ashes, and Paris green spray is also effective, but care is necessary in using this latter material. The lime should be dusted over and under the foliage. So soon as rock melon plants are about 8 inches high, pinch out the top, and stop the main running vines at about 2 feet to cause laterals on which the rock melon is produced. If dry weather prevails cucumbers should be watered, and the cucumbers when fit should be gathered whether wanted or not, or the vines will cease bearing. Points of shoots should be pinched out. This is a good time to sow the large cattle pumpkins and grammas. Vegetable marrows may also be sown.

Garden and field peas should now be plentiful if the weather has been favourable, and the various sorts of French beans should be showing good results. Look after the potatoes now coming on and market those fit as soon as possible. Tomatoes may still be sown, and those already raised and fit should be planted out, giving them plenty of shade, and watering until established.

Growers of rhubarb will require to shade the plants in order to obtain good stalks, and the soil should be well mulched with about 3 inches of well-rotted straw manure from the stable. There is a steady demand for rhubarb in the River townships.



PINE-APPLES GROWN AT THE EXPERIMENTAL FARM, WOLLONGBAR.

Later sown crops of white rye are looking well, and in some cases are fit to harvest. The early-sown crops of rye at the Farm did not look so well, and one lot sown in a piece of land formerly under cane was very poor, the land being sour, and ergot was plainly evident. The crop would never come to anything so it was cut, and burnt as soon as it was dry enough. Rye is a cereal that grows to perfection here, but where grown for green fodder care should always be exercised in seasons like the present one especially, with so much rain prevalent, as ergot may be on the crop more or less, rye being very liable to it. *Claviceps purpurea*, Tul., or ergot, takes place when the plants are in bloom, the *mycelium* developing in the ovary, replacing the seed. Its action is exceedingly deleterious. Rye-bread containing an amount of ergot causes serious illness, and animals carrying young if fed on ergoted rye, will suffer from abortion, and so cause serious loss to the farmer.

If the weather is showery, pine-apples and bananas may be planted. It is necessary to plant them in situations free from frost and sheltered from very strong winds. As the country is being opened up by settlers, those who wish to grow such tropical fruits should carefully examine their farm as to its aspect and elevation, and having decided where the fruits are to be grown, be careful to leave sufficient of the native bush to form a necessary breakwind. It is no use growing anything but the very best variety of pine-apples if intended for market. The first crop of smooth Cayenne pine-apples obtained this season at the farm was excellent in quality and size. A few were sent to Lismore to ascertain the market value there, the rest of the fruit to Sydney. The best case of eighteen pine-apples sent to Sydney realised 18s. gross, or 14s. 6d. net after taking off commission, cartage, and steamer freight. The net Sydney price and the price obtained in Lismore was about equal, but, of course, Lismore market is soon supplied. The outside measurement of the case containing these pine-apples was as follows:—Length, 38 inches; breadth, 23 inches; depth, 13 inches; the cubical space of such case being 6 feet 7 inches. Under ordinary circumstances the charges on such a case would be 3s. 6d. or 4s. per the North Coast steamers. However, I had interviewed the officials of the N.C.S.N. Co. (Ltd.) when I was in Sydney, and explained the nature of the experiment as to the possibility of growing and shipping pine-apples from the Richmond River to Sydney. My suggestions were received in a cordial and businesslike spirit, with the result it was agreed any cases I forwarded should be legibly branded "Pine-apples," and the shipping charge, *i.e.*, freight, on a case of the size abovementioned would be 1s., irrespective of the number of pine-apples within the case. In packing, each pine-apple was cut with a portion of the stem on, *i.e.*, about 1 inch to 2 inches. Each pine-apple was carefully wrapped in paper, and when the first lot of nine pine-apples were laid in the bottom of the case, a layer of paper was spread before putting in the balance of the fruit. This fruit was sent to Mr. J. Lee, of 139, York-street, and of the Sydney Fruit Exchange. Every fruit was carefully examined before packing, in order to be sure there was not any visible blemish. The illustration

attached to this article is from a photograph of similar pines sent to the Hon. Minister for Agriculture.

I have frequently heard settlers express an opinion that, owing to the freight charges, it was useless endeavouring to enter upon such industries. Of course, these things cannot be jumped into all at once; but there is no doubt that if fruit-growers approach the carrying companies in the right manner, they will, so far as possible, be met in a proper way, and the greater the volume of export the cheaper it can be done in course of time.

Any pine-apples showing disease or deterioration from frost, or sunburn, or boring insects, should be cut off the plant and burnt.

Spray grape-vines with Bordeaux mixture to keep down oïdium and black spot.

Sugar-cane growers and mill-owners are now very busy. Every opportunity should be utilised to get the cane-cuttings planted for new plantations.

Where bulls are depastured, if they are not of a tractable disposition, it is advisable to periodically examine the nose-ring, if a permanently fixed ring is in use, otherwise an unlooked-for accident may happen. In this district, where the bulls are reared by hand and brought up almost entirely or continuously along with the dairy cattle, they are mostly docile, and a permanent ring is dispensed with, a thumb-screw ring being used when it is intended to travel the bull. Where a permanent ring is to be used, it is applied after the perforation of the nasal septum with a trocar or a punch-nippers, making an opening of a size corresponding to that of the ring. Sometimes the perforation is made with a hot iron. The trocar is, perhaps, the most preferable, the operator making a quick puncture through the cartilage and introducing the ring and fastening same at once. The hæmorrhage soon ceases spontaneously. The ring should be well and carefully cleaned before using.

HAWKESBURY DISTRICT—November.

By GEORGE VALDER.

Maize.

Sowing operations should be rapidly pushed on. The cold nights experienced during last month did much to retard the growth of the early crops, and in many instances the later sown ones will apparently give better results. The soil between the drills will require plenty of working, the rains have in nearly all instances been followed by strong drying winds, and unless the cultivator is put through the crop frequently the soil will cake. It is also very necessary that the weeds should be destroyed as soon as they appear.

It is to be hoped that the farmers, in the maize-growing districts, will give more attention this season to improved maize-harvesting machinery. I believe that in this Colony we are more backward in our system of maize harvesting than in any other maize-growing country. Queensland farmers are turning their attention to the use of the corn-harvester, and they have made a decided advance in threshing, as the following extract from a paper read by Mr. W. D. Lamb, of Gangan, Darling Downs, will show:—"Harvesting is done by pulling off the cobs from the stalk, with the husk on, and throwing them into convenient heaps, when a dray or waggon comes along and carts them to the shed, or more commonly into a heap in or near the field. Then the thresher comes along in the shape of a machine that is capable of husking, shelling, cleaning, and bagging ready for market, up to 1,200 bushels per day. The machine is drawn about by a traction-engine, which also drives it when at work. The engine draws the machine into its place, then backs off to its place behind the thresher; the belt is put on an elevator running out to the heap to haul up the cobs, and there is also one to stack the husk and cob. Three men with iron scoops take their position at the heap, and two men at the bags. The whistle is sounded, the engine starts, and down comes the clean maize into the bags at the rate of 100 bushels per hour. Nineteen-twentieths of the maize on the Southern Downs is now threshed by this kind of machine, as it is so much cheaper than the old method. The total cost of threshing to the farmer is now 1½d. per bushel, as against 6d. to 8d. by the old method."

Many specimens of maize affected with smut were sent in last season for identification.

The species of smut affects corn alone, and, therefore, it can be eradicated by changing the crop. All smutted stalks should be carefully gathered together and burned. The disease is, however, often also spread by means of the seed—the spores adhere to the seeds, and being sown with them enter the plant in its early stages and grow with it. After a time the patches are seen in various parts of the plant, the cobs especially being affected and soon becoming a ball of smut. This can be prevented by soaking the seed in a solution of bluestone for fifteen to twenty minutes; about the best strength being 1 lb. bluestone to a gallon of water. The Jensen hot-water treatment can also be recommended. The spores adhering to the seeds are destroyed by the treatment. Once the smut attacks the crop no treatment will be of any benefit.

Sorghum.

As soon as the wheat and oats are cut for hay, plough up a portion of the land and put in a crop of sorghum. Sow the seed as soon as rain comes, and in most seasons heavy crops of forage can be obtained for use in autumn as green fodder, and also large quantities can be stored in the form of ensilage for winter and spring use. It is generally considered that it is more difficult to make good sorghum silage than it is to make maize silage. The reason for this, no doubt, is that sorghum has a great tendency to develop acidity. It therefore requires

to be very quickly made, *i.e.*, the silo must be very quickly filled. Like maize, it should not be fed alone; if possible, in filling the silo, mix lucerne or some other leguminous fodder with it.

The seed is very similar to shelled maize, but has not quite as high a feeding value; mixed with oats and peas it is a valuable food.

It is also a valuable fodder for grazing pigs on. Quick-growing varieties which are short in the stalk and produce heavy crops of seed, such as Milo maize, being especially valuable. Early varieties, such as amber-cane and orange-cane, are also very suitable for this purpose. Even for grazing, however, it is best to feed some other crop with it, such as lucerne, cow-pea, &c.

Broom Corn or Broom Millet

Can still be planted. Crops that are above the ground should be thinned out when a few inches high. This is rather tedious work, but will pay, as it means a more even growth, and the plants mature evenly.

Millet.

I would advise farmers who have small patches of land not sown with maize or other crops to at once put in a crop of Hungarian millet. Should we get anything like the average rainfall, millet, being a good drought-resister, will yield a heavy crop of forage. This crop can be cut in the same way as wheat or oats, viz., with a reaper and binder, and be made into hay, as it is easily cured. It is a much quicker-growing crop than either wheat or oats, and therefore occupies the land for a much shorter period, being often ready to cut in ten or twelve weeks, and in a good season in less time than that. The seed can now be purchased very cheaply in the Colony, and therefore the expense is no greater than for sowing other cereal crops. Very heavy yields of hay are obtained from this crop; one reason for this being that the stems of the millet, unlike those of the wheat or oat plant, are solid, and therefore the hay weighs heavier. Injurious effects are said to sometimes result from feeding millet-hay to horses and cattle. There is, I believe, some danger of injury occurring if the crop is not cut early. It appears that the ears are armed with small awns, which become sharp and harsh as the crop ripens. If, however, the crop is cut when the ears are quite green, they do not cause any ill effects. I do not, however, advise feeding on millet-hay alone; but if chaffed with equal quantities of wheaten or oaten hay, and a much smaller quantity of lucerne hay, it makes an excellent feed for horses or cattle. If cut when the plant is quite green, a second and even third crop can often be obtained. On farms where sheep are kept it is a good plan to turn the sheep in when the second crop has reached a height of, say, 10 or 12 inches. In a good season this should also be done with the first crop, as if the sheep are not left on the crop too long the plant will shoot out, and probably yield a very heavy crop. Salzer's Dakota millet will generally yield a heavier crop than Hungarian, but at present the seed is rather scarce.

Pumpkins and Melons

Should receive attention this month, as the resulting crop depends to a great extent on the cultivation given during the early stages of growth. The weeds should be kept down and the soil between the hills given a thorough stirring. In dairying districts the Rio pumpkin should be largely grown. It is, as a rule, a heavy cropper, and forms a valuable addition to our autumn and winter fodders, being extremely valuable for cows and pigs.

Root Crops.

Mangolds and Sugar-beets should be thinned out as soon as the plants have four leaves. Keep the ground free from weeds and well stirred. Should the plants appear to be growing rather slowly, top-dress with small quantities of sulphate of ammonia and kainit. If sowings are made this month sow somewhat thicker. Late crops should always be more thickly sown than the early ones.

Leguminous Forage Crops.

Cow-peas, Soy Beans, &c., can still be sown. From present appearances, I think that the heavier crops will be obtained from the late sowings. I notice that in the United States several varieties of cow-peas have been introduced which mature much more quickly than the varieties under cultivation here, and I am endeavouring to obtain seeds of these for trial here. Early maturing varieties would be especially valuable for late sowings in seasons which had been unfavourable for the early crops.

The Florida Velvet Bean, which has of late years been advocated as a valuable crop for green-manuring in warm countries, has come in for considerable notice lately. In Queensland, and also in this Colony, it has been tried in very small quantities, but so far, the reports received are very conflicting. Until the crop has been tried on a large scale, it is hardly fair to say whether it is a valuable acquisition to our leguminous crops or not. Small sowings have been made at the College Farm, and the seed produced will be carefully saved in order that a trial on a large scale may be made as soon as possible.

On light, porous soils the cultivation of pea-nuts for feeding to pigs will often pay. In favourable situations and in a fair season the crop will mature in three months, and the pigs can be turned in to feed the crop off in less time than that. The forage when the pods are about half-formed is excellent feed, being, it is said, richer than red clover.

Orchard Notes.

W. J. ALLEN.

November.

Give cultivation your most careful attention during this month, stirring the soil immediately after each rain as soon as it is dry enough to get on the orchard. Use small tines on the cultivator so as not to turn up too much moist earth but merely stir the soil well, keeping it pulverised and loose, which enables it to retain the moisture and prevents evaporation. In dry districts ploughing should never be resorted to in the summer, as it exposes and dries out the subsoil; but in the moister districts, where rain is frequent, a summer ploughing is sometimes beneficial, as, when the weather is showery for any length of time at this growing season, it is a difficult matter to keep the weeds in check. This, however, can be easily done by removing the small tines from the cultivator and substituting the broad tines or sweeps, which vary in size from 7 to 14 inches in width; and one man with a good two-horse cultivator can cultivate 8 acres in a day, whilst with a plough 2 acres is a big day's work, and more often only 1 acre is accomplished.

Early in this month look to your apricot crop, and if this is found to be heavy, thinning should be commenced. This very important work is too often neglected and trees allowed to overbear, thus yielding heavy crops of inferior fruit, which finds very little sale. No hard and fast rule can be laid down, but the grower will have to be guided by the condition of his trees. Leave on only as many as you feel satisfied that the tree can properly mature without weakening it. Proper pruning and thinning will so regulate the crop that the tree will be enabled to bear a regular crop every year. On the other hand, if this work is neglected there will be a heavy crop of inferior fruit one year, and a very light crop the next. I would strongly advise all growers who expect good crops of this fruit to make preparations for either handling, or selling to some of the canning and jam factories, a certain quantity of their fruit before the busy season is upon them, and those who neglect to make such preparation will find that there will be a glut of fresh fruit on the Sydney market; and, consequently, in order to get rid of their fruit, they will have to sell at a ridiculously low price, or, in all probability, lose the largest part of their crops, as when an apricot is ripe it has to be handled almost immediately.

Where irrigation is practised it may be necessary to irrigate such fruit-trees as are heavily laden; if so, be very careful not to flood the

land; but keep the water confined to furrows, running from two to four furrows between each row of trees, according to their age. My advice is to give the orchard as little water as possible, so long as the trees are growing well and properly maturing their fruit, but give thorough cultivation. By this I do not mean to stint the trees of water, as frequently it happens that the fruit, when well grown, will drop from lack of moisture; but when irrigation is carried out let each watering be thorough instead of being half done, and necessitating frequent irrigations.

Disbudding and summer pruning should receive best attention. This work is confined mostly to the young and vigorously-growing trees while being formed during the first few years of their lifetime, as once they start bearing regular crops their energies will be devoted to fruit-bearing, and not to growing surplus wood. In disbudding young trees select three or four of the best young shoots, situated evenly around the trunk of the tree, and 3 or 4 inches at least from each other. The remaining ones may be rubbed off, or, in cases where the tree is very much exposed to the hot sun, they may be simply pinched back to about 2 or 3 inches, or just sufficient to shade the trunk and protect it from sunburn, until the top is large enough to do so.

Vines should be disbudded, and all suckers growing from below the crown and near or underneath the ground removed. They should also have received a sulphuring both before and after the fruit has set. This important operation should be performed whether oïdium has made its appearance or not.

Every care should be exercised to destroy the codlin moth. It has been found that they do not lay their eggs in the calyx, but on the smooth surface of the fruit. The worm, however, usually enters the apple at the blossom end. The moths make their appearance about a fortnight after the fruit has finished blooming, and having found the way into the calyx, feed their way into the core, usually taking about a week, and there remaining feeding on the fruit from three to four weeks, finally eating a way out again. The bandages should be looked to regularly—at least once a week—and spraying as directed in a previous number of this *Gazette*.

All citrus trees attacked by Maori or other fungus diseases should be sprayed with Bordeaux mixture. Towards the end of the month, spraying for red and other scales should be thoroughly done.

For all those who have strawberries to market, I would recommend marketing them in nice chip baskets, holding 1 or 2 lb. each, and to avoid handling them any more than is absolutely necessary. When the fruit is picked and marketed in baskets or cases holding 20 or 30 lb., the fruit is almost worthless; and by the time the retail fruiterer weighs it out and puts it into a paper bag, it is more like jam when it reaches home than fresh fruit.

Practical Vegetable and Flower Growing.

By W. S. CAMPBELL.

Directions for the Month of November.

Vegetables.

In the dry parts of the Colony where the average rainfall is very light the difficulty of raising vegetables is great unless there is a good water supply for irrigating. Fortunately, up to the time of writing, the rainfall has been sufficiently satisfactory over a considerable area of the Colony to allow of vegetables being grown in abundance, and there seems to be good prospects that during November the season will continue to be satisfactory.

The liberal use of stable or farmyard manure, deep digging, good drainage, and the frequent stirring of the surface soil amongst growing vegetables, will, to a considerable extent, mitigate the effects of dry weather. Land may be rich, very rich, full of all the various kinds of minerals required by vegetables, but even the very best soils may dry up, cake, and crack, and become unfitted for vegetable-growing, or for the growing of any other plants, if it be devoid of vegetable matter, or altered vegetable matter; but this can easily be remedied on any farm by the heavy application of dung. Do not be afraid of applying abundance, dig it well in, and then apply more, and you will be fairly astounded at the good vegetables that will result, if, of course, they are looked well after during their growth—that is, by keeping down the weeds, and hoeing the soil pretty often amongst them.

Beans, French or Kidney.—Sow as large a quantity during the month as you are likely to require. Not all at one time, but (say) once a week, and as soon as any plants have ceased to produce beans, pull them out, apply some manure, and plant or sow some other kind of vegetable, (say) cabbage or lettuce, or turnip or carrot, or anything else you need; but, if possible, do not use the same ground for peas or beans of any kind. Try all sorts of kidney beans, dwarfs, runners, Lima beans, &c., for they should all succeed satisfactorily during the summer.

Beet, Red.—Sow a little seed in drills now and then, just a little at a time, for it is no use growing a heap simply to go to waste. Try the globe varieties, which are used a great deal now in preference to the large, long varieties, but it is as well to grow some of both. If you notice any pale, white-looking plants growing amongst the dark red ones, pull them up, for they will not be much good. The deeper red the better the beets will be; so it is no use going to the bother of growing vegetables which are not likely to come up to the mark.

Beet, Silver.—This is really a good thing for summer, being a sort of "cut and come again" vegetable. If you manure it well it will

reward you well, and a few plants will provide many a dish of very nice vegetable during the season. Pull the outside leaves only, and when they grow to a good size. When pulling the leaves take care not to injure the plants or pull them out of the ground, rather screw or break them off. There is a little knack about it, but after muddling to some extent it can soon be attained.

The seeds may either be sown in a small seed-bed for transplanting, or the seed may be sown where the plants are to grow. In this case make the drills about 20 inches apart, and afterwards thin out the plants to about 18 inches apart.

Broccoli.—The ground for this vegetable must be heavily manured, or it will not succeed so well as it should. From sowing the seed to the time it heads there should be no other check than transplanting; but even then there need be no check at all if the young plants be lifted properly. If they are hauled out of the seed-bed, roots all torn away, then popped into a dibble hole and covered up anyhow, they will certainly have a severe check, and take some time to recover.

Cabbage.—Manure heavily for the cabbage and all the cabbage family. Grow nice sturdy young plants in the seed-bed by sowing the seed thinly, then thinning out; afterwards pricking out, and then transplanting with care. All this seems to be a terrible lot of bother about a cabbage, which is supposed by most people to need little more trouble than growing a weed, and this is the very reason why hundreds and thousands of cabbages are failures every year. There are some places where climate and soil are so remarkably favourable that the cabbage will grow well with the most unfavourable treatment, but such places are very few indeed.

Lettuce.—As the lettuce does not stand transplanting very well during the summer, as it is then liable to run to seed quickly, the seed should be sown where the plants are to grow. Manure heavily.

Carrot.—Sow a few drills on a piece of land where cabbage or cauliflowers has recently been taken off. Then the remains of the manure, which the other vegetables did not need, will be available for, and in a good condition for, the carrots, and the soil will be in a good condition. Make the drills about from 12 to 18 inches apart. Thin out the carrots well after they have grown 3 or 4 inches in height.

Cauliflowers.—Sow a little seed and be careful to shade and water.

Celery.—Sow a little seed in some place where it can be looked after easily. When the plants are large enough to stand out by themselves, prick them out in a small well-manured bed, about 3 or 4 inches apart. They will soon make good plants for planting out in trenches. A few plants that may be ready should be planted in shallow trenches. Before making the trenches manure the land heavily, and incorporate it well with the soil. Plants which have grown to nearly their full size may be earthed up, in order to blanch their stems.

Cucumber.—Seed may be sown now anywhere in well-manured or naturally good soil. Plants which are making long growth, or are likely to do so, should be pinched back, and the vines had better be pegged down if they are liable to blow about at all.

Cress and Mustard.—Sow some seed now and then to keep up a supply. Use a good deal of manure to encourage quick growth. Liquid manure, made by soaking cow or horse dung, or both, in water. Should this ferment and stink a good deal, dilute it with water for use.

Egg Plant.—Plant out, if you should have raised any plants. If not, seed may be sown. A very few plants will suffice.

Leek.—Keep sowing a few seeds from time to time, if a continuous supply of this vegetable be required. The leek is a very good, useful thing, and might be used to more advantage than it is. It requires any amount of manure, and a good deal of moisture. Liquid manure it delights in, and will repay good treatment. Plant out a few young leeks in shallow trenches. Plant them deep, first trimming off any long roots.

Maize, Sweet.—Sow a few rows in rows 4 feet apart, and drop the seeds about 1 foot apart in the rows when the plants come up, and afterwards hoe frequently.

Melons.—Sow a few seeds of both rock and water melon. A plant or two of preserving-melons will probably be found useful.

Okra or Gumbo.—Plant out a few seedlings if you have some, or if not, sow a little seed. The pods are used for soups, stews, &c., and give a good body or consistency to them. These pods might be used to great advantage where soups are usually made like water.

Onion.—A little seed may be sown to keep a supply going. The onion-beds should be kept as free from weeds as possible. A mixture of soot and salt sprinkled about the onions will be found useful.

Peas.—Sow a few rows in the coolest parts of the Colony.

Peppers, Chili or Capiscum.—A few seedlings may be planted out, or seeds may be sown. The small poddel varieties are extremely pungent or hot, and those are the kinds chiefly used for making Chili vinegar.

Potatoes.—Plant a few rows, and use only the cleanest medium-sized seed.

Pumpkins.—Sow seed where this has not already been done. Pinch back all runners which are likely to grow too rambling.

Rhubarb.—Sow a little seed if any plants are likely to be required.

Radish.—Sow a little seed from time to time, and make use of the radishes whilst young and tender.

Sweet Potatoes.—These will succeed in all parts of the Colony which are not subject to frosts at this time of year and later on. Sandy loam in good condition suits them well. If too moist, the potatoes are likely to become insipid and watery. Plant tubers to grow shoots and vines for cuttings, for it is from rooted cuttings that the sweet potatoes are raised. When rooted cuttings are ready, plant them out in rows 4 feet apart, about 1 foot from each other. Prevent vines rooting, if possible, as they grow.

Spinach.—Sow a very little seed.

Tomato.—Sow seed if plants are likely to be required, or plant out young tomatoes which have already been raised.

Turnip.—Sow a very little seed in drills.

Vegetable Marrow and Squash.—Sow seed if sufficient plants have not already been raised.

WESTERN PINE.
(*Callitris verrucosa*, R. Br.)

Flowers.

The season has been most favourable for the flower-garden, even in some of the districts known as "dry." It is surprising how remarkably well flowering plants succeed in many of those places should but a very little seasonable rain fall, and their flowers are wonderfully good. For the next three or four months the heat will necessitate precautions being taken for the preservation of some of the plants, and one of the best precautions is the spreading a thick mulch of farmyard manure all over the surface of the garden.

Dahlias may be planted at any time during the month, as soon as the buds or shoots start into growth. Allow only one shoot to grow, and when planting, drive in a strong stake for a support to each plant. Give a good supply of well-decayed manure, and afterwards some liquid manure from time to time.

Those who are devoting some time and trouble to chrysanthemum-growing will have all their work cut out during the summer, for the plants will need a great deal of attention. They must be kept going on well without flagging. Abundance of water will be necessary, and some liquid manure occasionally. The plants will need training, suckers from the roots kept in subjection, and all growth kept within certain bounds.

Grown for ordinary garden purposes, they may develop without much trouble, and produce very pretty bright flowers at a time of year when flowers are generally very scarce.

Plant out any kinds of tender annuals that you have space for in the garden. Shade and water until they have established themselves. The most showy are the various kinds of cockscombs, especially the beautiful ornamental-leaved varieties, Salpiglotis, Portulacas, and Zinneas.

Western Pine.

The accompanying plate shows some typical specimens of the pine of the south-western forest reserves, from a photograph obtained by Mr. J. S. Cheesebrough, Inspecting Forester.

General Notes.

Orange-growing in Jaffa.

That much-prized fruit, the Jaffa orange, is now so well known and appreciated in England that it may interest readers to learn some details of the method of its cultivation.

The name by which this variety of orange is known in England is derived from the place where it is cultivated, the growing and prosperous little town of Jaffa on the coast of Syria, so well known to those who have visited Jerusalem, for which it is the port. Although not a native of Syria, it thrives on the sandy coast of that country better probably than anywhere else in the world, the climatic conditions—the rainless summer, accompanied by heavy night-dews, and the winter without frost—being well suited to the growth and development of the fruit. But the culture must, of course, be supported throughout the long summer by artificial irrigation. Were it not that water to any amount can be procured in every garden, and at a moderate depth, it would be impossible to grow oranges in Jaffa. The whole neighbourhood seems to cover a river of vast breadth, percolating through the sand *en route* to the sea. Hundreds of Persian wheels, working night and day, produce no sensible diminution in the supply of life-giving water.

Several varieties of the orange, such as the round Beladi, the Blood Orange, the Mandarin, &c., thrive along the coast of Syria, but the oval and almost pipless kind, known as the Jaffa orange, is only produced in Jaffa itself and its vicinity; and this peculiarity, according to the native gardeners, must be attributed to the quality of the brackish water used in its irrigation. Until about thirty years ago this oval form was quite unknown, when a native gardener, quite by chance, through careful attention to his trees, succeeded much to his own astonishment, no doubt, in improving his Beladi or Spanish variety of orange into the Shamuti, by which name the Jaffa kind is known in the vernacular. By selling grafts from his improved variety to other garden proprietors, he was instrumental in substituting the Shamuti for the Beladi orange throughout Jaffa. It is said to be a fact that all attempts hitherto made at growing the oval orange elsewhere than at Jaffa have not been successful; even at Sidon and Tripoli, on the Syrian coast, where the climate and soil seem precisely of the same nature as at Jaffa, all experiments in this direction have failed. Mr. Allen has, however, grown good specimens, and thinks that they will do well in this Colony.

The method of laying out a garden in Jaffa is as follows:—The land having been carefully selected and purchased—preference being always given to a red sandy soil—the owner will get in his workmen and start them on levelling and working up the ground. This is very

thoroughly done ; the levelling of the earth being important with a view to the future irrigating of the orange-trees. The ground is in the first instance well ploughed, and then, with the object of effectually removing every particle of weed, the workmen use their hoes to turn up the soil to a depth of fully 3 feet. This expensive process is very necessary, as the presence of even the smallest root of a weed will prove injurious to the trees, and be difficult to remove later on. While this work is going on the proprietor will have fixed upon the spot where the well is to be sunk, and have commenced operations. The depth at which water is found varies materially in different gardens, and ranges from about 12 to 60 feet below the surface; consequently the cost of sinking his well is always more or less a matter of speculation to the proprietor. The deeper wells are, however, the exception and not the rule. The system of irrigating is by Persian wheels, simple in construction, cheap, quickly made and repaired; and experience has shown that they are much better adapted for the purpose intended than the steam-pump. The whole of this simple machinery is quickly specified and described. A wide cog-wheel is kept going horizontally by a mule with a sweep; this turns a larger one perpendicularly, which is directly above the mouth of the well. Over this revolve two thick ropes, and upon these are fastened small wooden buckets; one side descends while the other rises carrying the buckets with them, these descending empty, those ascending full; and as they pass over the top they discharge the water into a trough which conveys it into an adjoining tank. The quantity of water discharged within the twenty-four hours depends on the speed at which the mule is kept going, and also, of course, on the depth of the well. An average-sized garden requires the constant labour of three to four mules to provide the necessary amount of water, the animals being relieved about every three hours.

The ground prepared and manured, the Persian wheel fixed, and accommodation—of the simplest kind, of course—being provided for the gardener and the mules, the proprietor now proceeds to buy young lemon-trees about a year old. These are meant to be used as stocks upon which the orange slips are later on grafted ; and of them there is always a fair supply available in the nurseries of the older gardens. These lemon-trees are now planted, under the supervision of the head-gardener, at a distance of 4 yards apart.

The young lemon-trees will now thrive without much further attention, except that they must be carefully irrigated ; this is done by a system of small masonry troughs running in all directions through the garden, and fed from the tank adjoining the well. The garden is generally divided into four equal parts, each part being irrigated within the course of two days, so that every tree receives its share of water every eighth day in rotation ; and this is considered ample. A small trench is dug round each tree sufficiently large to hold its requirement of water, and as the tree grows and needs a larger supply, the trench is enlarged ; the amount of water that will eventually be required must, therefore, be calculated on the basis of the irrigation necessary when the trees are 6 years old, and may be said to have

reached maturity. If the garden is a full-sized one, and contains about 6,000 trees, it will be necessary to sink either two wells or one well sufficiently wide to admit a double set of buckets, thus raising double the quantity of a single set in the same space of time.

During the winter months the garden is left to itself, the gardener employing his time in taking the mules to graze, thus saving the cost of feed. Irrigating commences about the end of June, and lasts till the end of October or middle of November (in Jaffa).

The young lemon-trees are allowed to grow for two summers before the orange slip is grafted upon them; this operation is performed in the autumn by the head-gardener, who is an adept at this work. After the fourth summer, calculating from the time the lemon stock was planted, a few oranges may appear on the trees; and during the following two years the whole of the expenses of a garden will, as a general rule, be covered by the sale of the orange crops.

It is generally assumed that after the fourth year a garden becomes self-supporting. After the sixth year, a garden that has been well attended to will not only pay expenses, but give a handsome return as well. The fortunate proprietor will now also have the further satisfaction of knowing that the marketable value of his property represents probably more than double the whole of his outlay. This will give an idea how profitable orange-growing in Jaffa really is to those who can afford to wait a few years for a return on capital.

Once the garden is in full bearing, the proprietor, apart from an occasional visit of supervision, has little to do beyond selling his crop of oranges, paying the expenses, and pocketing the balance.

It is difficult to calculate the exact cost of laying down a garden. The price of the land varies, of course, according to position and quality; then the depth of water below the surface, and consequently cost of sinking the well, cannot be estimated to a nicety. As a general rule, however, a garden containing 6,000 young trees will cost from £1,100 to £1,200 to lay down complete, with live stock. To this sum will have to be added five years' expenditure (during which period the garden is assumed to be unproductive) at the rate of £120 per annum, and making £600. We have, therefore, a total of £1,800, representing the capital outlay on the garden up to the time that the trees are in full bearing. From now onwards the crop of oranges will have an annual value of from £400 to £500; and this will leave the proprietor, after deducting all expenses for wages, feed of live stock, taxes, repairs, &c., a clear revenue of 10 to 15 per cent. on his total capital outlay of £1,800.

The risks which the Jaffa orange-grower runs, as compared with those which the New South Wales grower has to face, are infinitesimal. The storms that visit the Syrian coast, although of frequent occurrence during the winter months, are not of such force as to damage the trees; in fact, it is remarkable how very small is the proportion of ripe fruit even which falls to the ground after a storm. This is no doubt due to the fact that the Jaffa orange-tree is not allowed to grow larger than a good-sized shrub; and as the trees are placed only 4 yards apart, they afford each other very considerable protection from the force of

the wind. The cactus shrubs also, forming the hedge of the garden, grow very thick and high, and give additional protection from the storms. Blizzards which have proved so ruinous in Florida, and frosts which are experienced in this Colony, are quite unknown in Jaffa.

Owing to the good keeping qualities of Jaffa oranges, which enables them to be shipped to distant parts, there is always a brisk demand for them, and the grower has hitherto had very little difficulty in disposing of his crops at good prices. If not exorbitant in his demands, he can almost invariably sell his fruit for a lump sum while the fruit is still green, and before the winter, with its risks of hail, &c., has set in. The shipper who purchases the fruit in this way takes over the whole of the risk of any damage that may happen to it, and he cuts the oranges from the trees whenever it suits him to do so; the contract only stipulating that the garden is to be cleared by the middle of March, as the proprietor likes to see his trees free of fruit before the new blossoms appear.

The whole of the crop of Jaffa oranges does not at the present time exceed 300,000 boxes of about 160 oranges each, which is a mere trifle compared with Spanish or American crops, and about four-fifths of this quantity is at present shipped to England.

The orange-growing industry is almost entirely in the hands of natives; a few of the newer gardens are, however, owned by Germans and Frenchmen.—From an article by Reinhold Palmer, Jerusalem, in *Chamber's Journal* and *Planter's Monthly*.

A New Tomato Disease.

Mr. J. W. Mills, Superintendent of the Pomona Experiment Station of the Department of Agriculture, in a communication to the *California Fruit Grower*, says:—

"I have had considerable trouble at this station with a new disease of the tomato vine, and a great many growers have come here for information on the subject. The disease described in a Florida bulletin as *Bacillus solanacearum* seems, without doubt, to be the same as is affecting tomato vines in Pomona Valley. There are 15 acres of tomatoes near here that were the finest that I ever saw a month ago. (This letter was dated 27th July, 1899.) Now they are worthless. One man who had 5 acres of fine plants that were uniform in size and 3 feet high and across told me he had deserted his.

'Thinking you may have occasion to deal with this subject, I send you a copy of a short sketch of the disease, and a description of the manner in which it is scattered and combated. I have taken it almost wholly from eastern bulletins. The disease has not been scientifically dealt with in this State, and that was my only recourse."

[*Descriptive.*]

Our attention has been called to a disease of the tomato-plant that is this year threatening destruction to whole fields. For the last three years this disease has shown itself in Southern California, but not to any serious extent till the present time. The plants show indications of disease at all stages of growth. The lower leaves first turn a light green, then to a light yellow; the edges of the leaflets curl up and brown spots make their appearance on them. The general appearance of the plants would seem to

indicate that they were suffering from a lack of moisture. When small plants are attacked, they usually succumb in a short time. A large thrifty plant may become diseased and continue to bear fruit, but it will cease to be profitable. There are several diseases of the tomato that are described in bulletins issued by eastern experiment stations. These diseases are distributed, as far as is definitely known, from Mississippi to Florida, and as far north as New York. Some of them do not appear to show the same characteristics throughout the affected district, or else there has been some confusion in the names. The Florida station describes and illustrates our destructive California disease when it describes the eastern malady known as "Oedema," giving three causes: 1, an excessive amount of water in the soil; 2, an abundance of fertiliser, or an unbalanced fertiliser, especially one containing a large amount of ammonia; 3, the topping or suckering of vigorously-growing plants; all three in conjunction being very sure to produce the disease. This does not fit our case, as the disease is very destructive where none of these conditions prevail. What is without doubt the very destructive disease that is affecting commercial plantations of tomatoes in the Pomona Valley, is described in Bulletin 47 of the Florida Agricultural Experimental Station as *Bacillus solanacearum*. The disease is equally as destructive on potatoes and egg-plants. Dr. E. F. Smith, of the Division of Vegetable Physiology and Pathology, Washington, D.C., has experimented with the disease, and, as the results of his investigations are of importance to tomato and potato growers, he is quoted as follows:—

Natural Methods of Infection.

In the greenhouse, under strict control of conditions, the writer has been very successful in transmitting the disease by means of the Colorado potato-beetle, *Doryphora decemlineata*. The first experiment was begun July 23, 1896. A handful of beetles was placed under a bell-jar on potato tops taken from plants inoculated July 16. These tops had wilted and were becoming brown. The beetles fed upon them as readily to all appearances as upon healthy shoots. They were then placed for some hours under a large bell-jar on a well-grown healthy plant. The plant was eaten in many places, but was not seriously injured. The beetles were then removed and the plant was placed under normal conditions to await developments. On the eighth day there were slight indications of wilt on a dozen different leaves scattered over the plant, indicating as many separate infections. The weather was warm, and after a day or two these symptoms progressed rapidly. The wilting leaves shrivelled, and in a few days long brown streaks appeared inside of the stems, beginning usually at the base of the shrivelled leaves. In ten days from the appearance of the first symptoms the whole vine was involved, all the leaves shrivelled and wilted, and the stems became a muddy green, blackening in stripes internally, and finally shrivelled. Cross sections of the stems showed the vessels to be filled with bacilli. On 24th August the earth was knocked out of the pot, and the pot and tubers examined. These were found in all stages of rot. Three large well-grown potato-plants were subsequently inoculated in the same way and with the same result. In each case the disease began simultaneously in many different parts of the vine, seven to nine days after the beetles were removed, and the tubers were potted in whole or part three weeks after the appearance of the first symptoms on the foliage. The check plants remained healthy. These experiments with the Colorado beetle seem to fully warrant the conclusion that insect enemies are largely responsible for the spread of this disease. The direct injury resulting from their bite and punctures is not the only injury nor the worst one. Given one diseased vine in a field, and plenty of insects to feed upon it, and the transmission of this disease to all parts of the field, and thence to the neighbourhood, is only a question of a few weeks.

Just what insects are most instrumental in disseminating this parasite in any particular locality can be determined only after a prolonged and careful study of the disease in the field. No experiments have been made with other insects, but it is likely that many leaf-eating insects may act as carriers of the disease. No experiments have been made to determine whether this bacillus can gain entrance to the plant through an uninjured epidermis. Most of the infections probably occur above ground, and are the result of insect injuries. Very likely there are some underground infections.

Preventive Measures.—The prompt destruction of all leaf-eating insects and leaf-puncturing insects is one of the first things to be considered. How this shall be accomplished with the least outlay of time and money is a matter for the economic entomologist to determine. Of course, the more diseased plants in a field at any given time the more possible sources of infection. For this reason diseased plants should be removed and burned with great promptness. This is impracticable after a whole field has become infected, for then the mischief for the season has been accomplished. The time for such precautions is early in the season, when a frequent and thorough search should be made for diseased plants. This can be carried on along with the war of extermination against

the insect depredators. When the disease has become widespread in fields of tomatoes or egg-plants there is no help for it, but in the case of potatoes a considerable part of the tubers may be saved. If they are dug immediately and stored in a cold, dry place, delay in harvesting for any length of time after the vines have shrivelled means simply the infection of all the tubers and the loss of the whole crop, either in the ground or afterwards in the cellar. This disease sometimes appears on new ground—that is to say, ground recently cleared—and occasionally to such an extent as to lead growers to suspect the seed. The seed, however, is not necessarily the carrier of the disease, since beetles with the germs in their jaws can readily fly from one field to another. Such an explanation of the disease, however, precludes the possibility of the germ being permanently at home in certain soils, or of its being spread by seeds or infected seed potatoes. However this may be, the organism probably lives over winter in the earth of the potato fields, and, therefore, such infected soils should be planted to other crops for a series of years before again venturing these two crops or any other solanaceous plants known to be subject to the disease.

To recapitulate, prevention of this disease lies in the direction of the prompt carrying out of the following measures:—

1. Early and complete destruction of insect pests;
2. Early and complete removal of diseased vines;
3. In the case of the potato, the prompt digging of the tubers and their immediate use or storage in a cold, dry place;
4. Selection of land for subsequent planting which has not been planted in tomatoes, egg-plants, or potatoes for several years.
5. Selection of tomato and egg-plant seeds and potato tubers from plants grown in localities where this disease does not prevail.

Experiments at the Florida station show that different kinds of fertilizers have no influence in checking the disease. That the disease spreads most rapidly when the vines are vigorous and grow close together. Some varieties are more susceptible than others, but the finer varieties are all subject to the disease to a point of unprofitableness.

Some growers may anticipate growing a late crop of potatoes where potatoes have died off early in the season. This will not be possible with this disease. Sweet potatoes can be grown on the same land without fear of a failure from this malady, but the season is too far advanced to admit it at this date.

So far as the Department is aware, the disease has not been reported in this colony yet, and tomato-growers are invited to submit for examination specimens of plants that show any of the symptoms mentioned. Such specimens should be wrapped in a damp rag and enclosed in a little tin—a little mustard tin will be just the thing. The packet will be transmitted to the Department post free if one of the labels to be found in each copy of the *Gazette* is attached.

The Liverpool Plains District.

Mr. C. W. B. King, C.E., Licensed Surveyor and Land Appraiser, forwards the following interesting account of the Liverpool Plains district:—" During the last few weeks professional work took me to the Liverpool Plains, one of the northern districts of the colony, and it has occurred to me that a brief description of this valuable agricultural and almost unsurpassed natural pastoral district might be interesting to many of the readers of the *Agricultural Gazette* who are not personally acquainted with this locality. I have endeavoured frequently to impress on many of my friends and acquaintances in search of good land the value of this district, but it always appeared to me that its quality was not appreciated as it merited; therefore, during the last few weeks, I was pleased to see the strides agricultural pursuits had made since a previous visit nearly two years ago, and I

have no doubt that next year will see the wheat crops doubled. The locality in question consists of parts of the counties of Buckland and Pottinger, and is bounded on the south and east by the Liverpool Range (which divides the eastern and western waters), on the north-east by the Piallaway Range (which divides the counties of Buckland and Parry), on the west by the Mooki Kiver, and the very rich country extends beyond these limits I do not propose to go further in this paper. The aspect of the country is mountainous on the east, north-east, and south (the Liverpool Range attaining heights varying from about 2,500 feet to over 4,000 feet above sea level), falling suddenly to flat on the north-west. The geological formation of the range is generally basalt, and the formations of the district are basalt, conglomerate, and sandstones.

From the very summits of the ranges, at intervals of every few miles separated by mountain spurs, a number of perennial creeks arise and meander northwards, westwards, and southwards—as the case may be—to the flat plains below, and there most of them run out, having apparently carried the decomposed rocks and organic matter with them downwards during the countless ages of the past and deposited their precious burdens in the hollows which upheavals of the sedimentary formations below formed, and which, being filled with these rich substances, resulted in the formation of what is now called the Liverpool Plains, which are unsurpassed for richness, and the soils of which, for fertility and diversity of quality, consisting of light sandy loams, volcanic loams, and loamy clays, and the rich black and chocolate clays, resulting from the disintegration of the country, rocks combined with the decayed organic matter, can compare with anything of the kind in the Colony. The water in the creeks is pregnant with lime which appears to suit animal and plant-life well, and though hard is not unpleasant to the taste after you get accustomed to it. Similar water can be obtained in most places at depths ranging from 10 to 150 feet. The Northern Railway enters this fair land at Ardglen, and passes through Willow Tree, Quirindi, Quipolly, Werris Creek (the junction of the Northern and North-western lines), passing out at Currabubula on the Northern and Breeza on the North-western line. There are many villages and hamlets not at present connected by the railway service. The large pastoral holdings are Warrah, Colley Creek, Walhallow, and Piallaway, Breeza, Mooki Springs, Kickerbell, Wallabadah, &c., which are all freeholds, having been alienated by the Crown many years. These holdings lock up from the farmer many thousands of acres of fertile lands, the owners of which, I venture to assert, will in the near future see the advantage of opening them up to the husbandman. The climate is genial and pleasant, tempered in the summer by breezes from the surrounding ranges; warm to hot in summer, and from mild to cold during the short winter which obtains here; spring and autumn being particularly agreeable; and though the temperature occasionally ranges high by the thermometer still the heat is dry and not continuous, and the nights are usually cool and refreshing; there is little or no dew during midsummer. The black-soil plains are mostly

Stools of Wheat from a 150-acre Paddock on the Liverpool Plains.

covered with immense growth of the variegated thistle thought much of by pastoralists, and which will supply food in the shape of silage in great quantities, rendering the stock-owner less dependent upon the seasons. The natural pasture grasses which grow in great profusion are rich and lasting, and are proved to be very pick of flesh and wool producing foods, amongst which are Blue (*Andropogon affinis*), Kangaroo (*Anthistiria ciliata*), Star grasses (*Chloris truncata*), Oat grasses (*Bromuss arenarius*), several Panic grasses, and a large tussocky grass known as Liverpool Plains grass, besides the many local spring, summer, and autumn grasses, a limited amount of Couch Grass (*Cynodon dactylon*), with a share of the wire and spear grasses also. I am assured that if the holdings were divided in moderately-sized paddocks no difficulty would be experienced in carrying from one to two and even more sheep to the acre according to the locality, and keep them in good condition too. I have suggested to some holders the advisability of introducing some of our well known dry country grasses, viz., Mitchell Grass (*Astrelba pectinata*) and (*Astrelba triticoides*) and Landsborough Grass (*Anthistiria membranacea*), also *Paspalum dilatatum*, which ought to do remarkably well here, and during this year these will be tried. Many exotic grasses flourish in great profusion, viz., Prairie (*Bromus unioloides*), &c., clovers, &c. The spring herbage is plentiful and assorted, viz., trefoil, crowfoot, carrots, wild mustard, &c. Great endeavours are made to destroy the Bathurst burr, black thistles, horehound, &c., with fair success, but which efforts should not be abated. The rainfall varies from 28 to 32 inches on the plains to 40 inches on the mountains, a plentiful supply for purposes of pasture and agriculture. For years agricultural pursuits have been followed in various parts of the district; but, as a result of most of the best land being locked up in large holdings, a damper has always stood in the way of the agriculturist. I know of no better wheat or lucerne land in the Colony, and was greatly pleased by the sight of many fields of healthy-looking wheat, which I was enabled to inspect through the kindness of Mr. L. P. Doyle, of Box Hill, who drove me round. I send you a sample from a 150-acre paddock, which looks remarkably well. In one of the roots I found 160 stalks emanate from one seed. Lucerne grows to perfection in this locality. In many parts of the district maize and sorghum grow well, and are profitable crops, and different root crops flourish, though potatoes do not appear to be so successful as they should be. The land is usually timbered with box (white and yellow), apple, pine on the sandy parts, and little undergrowth except on the sand hills, which rise out of the plains like islands in the sea, the process of preparing the ground for the plough being to ringbark the timber, and, when dead, burn off at a cost of 15s. to 30s. per acre. I must not forget to mention that that great, profitable, and rapidly increasing industry, dairying, is very successful where the situation of the land permits the farmer to send his cream by rail or trap to the factories, and I venture to predict a large and continually increasing trade in butter from this district. Fruit trees, vines, and all allied species flourish; but there is not sufficient demand

locally to encourage the fruitgrower, though the future will see a large business in fruit, wines, and jams from here. Should any of your readers require farming land, I recommend them to visit this district before settling upon a farm, the result of which will be satisfactory to the visitor, there being good prospects of obtaining first-class virgin soil at a reasonable figure. The elevation of the district is from 1,200 to 2,000 feet above sea level, but, generally, between 1,200 and 1,500 feet. If an experimental farm were to be established by the Department anywhere in the locality of Quirindi, the result would be of immense value to the district, and open up opportunities to the local residents to see and learn scientific farming. In my next I will deal fully with the agricultural capabilities of the locality, giving the returns of wool and crops generally.

Fungoid Diseases destroying the Plague Caterpillars and Cut-worms.

The fungus disease reported by the Entomologist to be destroying the plague caterpillars that have been doing so much damage during the last four months through the whole of the Central districts of New South Wales, appears to be so universal in its effects that very few of the full-grown caterpillars will ever reach the pupal stage to produce a fresh crop of moths. Specimens have been received from all parts of the infested districts; but not a single one has reached maturity, though carefully fed and looked after in the breeding cages, one after the other having developed the fungus parasite. The caterpillars in the field when suffering from this disease become listless, black, and shrivelled, bury themselves in the ground, and are eaten by the more active ones, so that the infection is rapidly spread. If there are any stumps, shrubs, or fences in the locality the dying caterpillars always crawl upward, so that every projection becomes festooned with outstretched, dry caterpillars.

There are two very distinct groups of caterpillars in the Southern districts—first, the true plague cut-worms (larvae of either *Agrotis mundi* or *Agrotis infusa*, as specimens of both species have been captured in the infested districts); the second species is a much more brightly-coloured grub, covered with stout hairs, which does not do anything like the damage that the first one does, confining its attacks to the grass lands. This is probably the grub of the well-known "grass moth" (*Apina callisto*), as great flights of these bright yellow and brown moths were noticed in the same districts early in the year.

The fungus has been identified by Mr. McAlpine, of Melbourne, as a new species of the genus *Entromopthora*, a group now recorded for the first time in Australia, but species of which are well-known in other parts of the world as very destructive to insect life. The well-known disease (*Empusa museæ*) attacks the common house-fly, and attaches it to the window-pane, covering it and the glass beneath with a cloud of white filments. The "locust fungus" *Empusa grylli* is known to destroy both gnats and locusts in Germany and America.

Two other allied species, *Entomopthora aphidis* and *Sporotrichium globuliferum*, so closely associated that it is difficult to determine which of them is doing the work of infection at the time, have been described from America by Professor Forbes as destroying countless millions of the Church Bug (*Blissus leucopterus*), one of the most destructive wheat pests in the world.

Mr. McAlpine proposes the name of *Entomopthora australis* for our species, and informs me that he has also obtained this fungus from Bacchus Marsh, Victoria. Many experiments have been made in the United States and South Africa to artificially propagate the fungoid spores among the healthy locusts and chink bugs; but the results have been very irregular, as a good deal seems to depend upon the state of the weather at the time the spores are scattered over the ground—warm, damp days being necessary to develop it rapidly.

A quantity of diseased caterpillars have been collected by the Entomologist, and on the first appearance of the caterpillars in a clean district will be used among them to infect them before they have done all the damage.

Some New Appliances.

Mr. Hugh Dixon, of Messrs. H. Dixon and Sons, who is at present on a visit to the Old Country, has been good enough to forward the following account of some new appliances he has had opportunities of seeing, and in which agriculturists generally will be interested.

The Darby Land Digger.

Last Saturday I went to Chart Sutton, 4 or 5 miles from Maidstone, to see this machine working. When I arrived on the spot it had already been working for some time, having been three or four times up and down a piece of ground which was as nearly as possible 500 yards long. They had just mowed a crop, which I understood had been a good one, of mixed grasses, I suppose, for hay. The stubble was still green, and I heard a man say that if it had been left they could have got another crop from it. The roots were consequently all fresh and in good order, holding the soil well together to at least 3 or 4 inches down to 5 or 6 inches. It was, just as near as I could judge, what ground would be like if a fair crop of oats had been taken off, except that the stubble was not so coarse. The soil itself was rather an open one, *and was also fairly dry (note this)*, but not bone-dry; it was also fairly, if not very, strong; and continually you could hear the machine, as it was going along, working against stones, and now and again it would throw them to the surface; or when it did not, on two or three occasions when it seemed to strike a large one, these were sought for, and were found to be up to, say 12 in. x 9 in. x 2 in. or 3 in. thick, of course irregular in shape. Up to that size it may be fairly reckoned to disturb them. On my arrival the machine was at a stand-still, it having been discovered that a number of the discs (steel), which are about 8 inches in diameter, had worked loose. Mr. Darby, who was superintending the affair, said this was a new experience to them, and he thought it was the dryness of the ground; apparently they had never worked such dry ground before. I am somewhat inclined to think that the stones had something to do with it. He said that the fault was easily curable, in which I agree with him, by putting a pin through the bottom nut. To my mind, however, a lock nut would be better, for the reason that if they broke a disc it is less trouble to undo nuts than to take out pins. After they had tightened the discs I waited to see them run one length of the field and start the return, the latter of which I was desirous of seeing. Its treatment of the soil is quite different to that of the plough; it does *not* turn the soil over, but it *does* work it up very fine, quite as fine or finer than well harrowed ground, but leaves the grass or stubble on the top, the great bulk of it standing upright. It works a good deal of the soil out from the roots, but not entirely so; in fact, it sort of grinds the soil. The machine itself is like a large iron, the two

arms of the frame being attached close up to the outside of the axles of the 8 h.-p. traction engine. When it comes to the end of the field it has to back and fill, or zigzag, the same as you would turn round a cart in a very narrow passage.

The machine goes backwards on the top line and ahead again, but they take one more zigzag than is shown in the sketch. By this means it ploughs the ground right up to the edge—that is, more closely than ordinary ploughing would do, unless you plough crossways at the end of the furrows. As the digger finally follows every spot that the traction engine has been over, no pressed down soil is left. I do not see why the machine could not be run round and round in the field in the same way that a reaper and binder is done. This would save the time occupied in turning round, and though the engine would have to come out finally over ploughed ground, the ploughs could be kept working, and this would be quicker in the end.

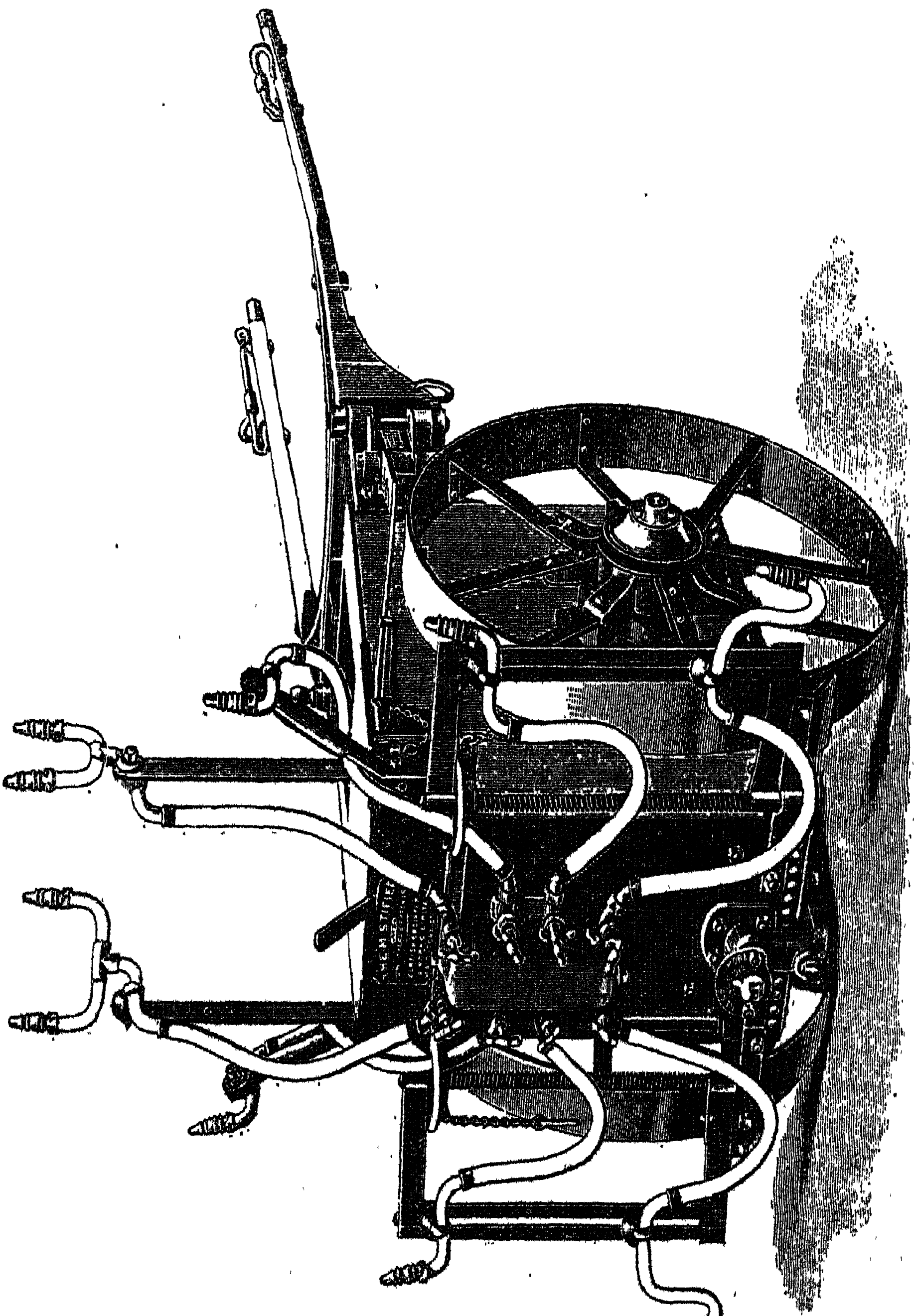
An irregular and smaller piece of ground would thus be more advantageously worked. Of course the machine will not turn round in a very narrow space or in a sharp angle without this backing and filling. By going continually round the ground it could plough close up to a fence, as the outer discs project some foot or more beyond the line of the wheels of the traction engine. The owners of the patent put a different cap on to the ends of the axle of the engine to that provided by the engine makers, specially for attaching the machine to the caps. The stubble or rubbish growing in the field being left on the top permits of its removal by harrowing or otherwise, where it would be desirable to remove it, as in the case of docks. The seeds of weeds also are not buried so deeply; so that, where a scarifier is run between the lines, the plants, as in thistles, would be more easily dealt with—that is, the scarifer would cut the roots instead of the plants.

There is a wheel for lifting or sinking the diggers as required; a steering wheel for the engine; a cog-wheel and shaft for transmission of power to drive the digger. The discs themselves should not revolve, as they are jammed tight on to their spindles. The centres of the discs are raised. The spindles to which the discs are fastened may and do revolve in their sockets. The yokes—that is, the two sockets with the cross piece—are one casting, and in revolving do not do so on an even plane. This, with the "dishing" of the discs, lifts the ground as it is cut; consequently, even in ground that is moist, a clean face or "sliver" is not left as with a plough. The bottom is not very rough it is true; but it cannot have a polished face. The revolving of the spindles rubs the soil and breaks all lumps, even rubbing a great deal of it out from fresh roots. Of course it does not break stones or even shale; but I am perfectly satisfied that it would smash up clods. As I saw it digging it was doing a good 6 inches, while Darby claimed that it was doing 7 in. to 7½ in. I do not think it safe, or at any rate well, to attempt more than possibly 5 inches for the first time in heavy ground that had not been ploughed previously; if more were required it would be better to go over it a second time. This would, from the nature of the machine, not bring the lower soil to the surface although it would mix it a little. It would certainly be very unsafe to work the machine in land that had not been thoroughly well cleaned of stumps and rocks down to any depth that the machine would be required to work. I would not like to require it to cut eucalyptus roots thicker than an inch and a half.

Land that had had timber growing on it, or that had boulders in it, should be first gone over with a subsoil plough. I believe, however, that it would not be difficult to have something in the nature of a coulter working after the principle of a stump-jump plough to detect where obstructions existed below the surface. Clearly understand that this is only an idea of my own, as it is necessary to remove such obstructions. In starting the machine the discs are lowered into the ground by a wheel; it moves forward a little, and is further lowered; then it moves backward, and is lowered further still. By working it this way, instead of giving the whole amount at once, you get the whole depth from the start; otherwise the machine would have to move 15 or 20 feet before the whole depth was reached.

An advantage of the machine not turning the soil over is that it leaves any manure that may be applied, comparatively speaking at any rate, on the top; also, it will not turn manure under the surface as does a plough. In moving over the field where it is required to work, the discs and spindles may remain on, as they can be raised clear of the ground, I think 3 or 4 inches; but where any distance has to be gone over roads, it would be desirable to remove the yokes, or at any rate the spindles. Although the machines dig 12 feet wide, the outside forks on each side of the triangular frame being hinged to turn inward towards the tender of the engine allow of a reduction of the extreme width to less than 9 feet. This is important as it answers a very natural query as to how the machine could go through, say, an ordinary 9-foot gateway.

For Australian use it would be desirable, as for other agricultural engines, to have a fire-box suitable for wood.



"THE MISTIFIER."

A person with whom I have had some correspondence claimed that it could be used for dam-sinking. It could only be used where a traction engine could be worked, so that there are not many dams even in Australia where it would be of use; but it could be used for levelling even to a large extent at one operation by dragging a scraper after it.

Another advantage that the machine would have in Australia is that there would be no waiting for rain before digging, and any one who has given the matter any consideration knows that land ploughed dry is far better for several reasons.

The weight of a traction engine of eight-horse power would only be about 1¼ ton more than the ordinary agricultural engine of the same size. This is due to the water in the boiler; but the wheels being so much broader would cause it to sink even less. Over a great part of Riverina, and similar country these engines would be very desirable; but they could not travel when the roads are soft from rain, nor do I think they could cross creeks where the banks are steep, and certainly not where the water would reach the fires.

I would most strongly advise the Government to try one of these machines at the large experimental farms.

Other Inventions.

Another machine that I would strongly advise the Government to try, where they have large numbers of trees to spray, is Drake and Fletcher's (of Maidstone, Kent) "Mistifier." This is a machine which was tested by a committee of experts, and awarded the prize for spraying hops. I saw the machine, though not at work, at the Maidstone Show. As the horse drags the machine along between the rows, it also works it. It can be practically made to spray any height.

It would be an immense advantage to Australia to have such a show at each of the great centres, such as that held at Maidstone this month. There are so many things, large and small, that would be useful to people in Australia which, though the demand would not be so great as in this country, it would be worth while to introduce. For instance, some cooking utensils and a potato-cleaner, manufactured by F. Hancock & Co., 29, Oxford-street, Dudley, Worcestershire. This latter cleans and peels as many potatoes as would serve an ordinary family, say, 2 lb. of potatoes in about two minutes. Stopped at the right moment, it has removed no more than every particle of skin, and cleaned the eyes right out, leaving an old potato with the appearance of a new one; at the same time, the servant has not to handle the potatoes, except to put them into the machine, until they are thoroughly washed and cleaned, thus obviating the great objection of rough hands, which makes servants dislike the work.

Thinning Tomatoes.

An experiment to test the advantages of thinning tomatoes was tried last season at the Arkansas Experiment Station (U.S.A.). Two lots, of twenty-five plants, were grown under precisely similar conditions. The plants were tied to stakes, the lateral branches below the first cluster of blossoms were pruned off with a sharp knife, and a spray of Bordeaux mixture was applied to all. In one lot the fruits were allowed to grow as they set; but, in the other, when the tomatoes were ½ to ¾ inch in diameter, not more than two or three fruits were left on each cluster. Deficient rainfall and high temperatures affected the thinned plot less than the unthinned, and the results were greatly in favour of thinning the fruit, so far as single specimens were concerned. The average weight of a single tomato from the thinned plot was about 15 oz., against 6 oz. from the unthinned. Taking the total amount of fruit produced per vine, however, it was shown that when the fruit was not thinned each plant yielded about 10 lb., while the thinned ones gave 9 lb.; but in appearance and quality—the crux of the question—thinning came out on top.

Replies to Correspondents.

Preservatives in Butter.

A PARKES correspondent writes: "I should like a little information about the use of preservatives other than salt in butter-making. Taking, for instance, boracic acid, is it advisable to use this for butter that has to be kept for some time either in cool storage or at the ordinary temperature of the air? If so, what is the correct quantity of same per lb. of butter? Is this the most preferable of preservatives?"

Mr. M. A. O'Callaghan reports: "The use of preservatives other than salt is not to be commended; but a ½ per cent., that is, about ½ oz. to 6 lb. butter of boracic acid is not objectionable."

To Destroy Ants.

IN reply to Mr. H. V. Holcombe, who asks for information as to best means of getting rid of ants, Mr. Froggatt says bisulphide of carbon is one of the best things to employ. Pour about a large tablespoonful of the fluid down each hole in the ants' nest. Cover at once with a damp bag. Remove the bag after two minutes, and apply a lighted stick over each opening, when the ascending fumes will catch fire and burn right down to the bottom of the burrows, causing a small explosion, and wrecking the interior of the nest. This will destroy nearly every ant, and if there are a few stragglers left they will soon vacate. The greatest care should be taken not to put a light near the bottle of bisulphide, and it should be kept well corked. The operator need apprehend no danger if a 6-foot stick is used with the light.

Rotation in Vegetable-growing.

IN reply to inquiries as to how to practice a system of rotation in vegetable plots so as to get the very best results without overtaxing the land or wasting manure, Mr. W. S. Campbell says:—"Wherever this can be carried out vegetable growers should do so; but however excellent this advice may be it is by no means easy to carry into practice, as any one who attempts it will discover. There is generally some little hitch cropping up to prevent the sowing or planting just at the proper time, due very often to our variable seasons. In order to enable any one to make a trial I have grouped together those vegetables, which are generally grown, under their natural orders, so that the mistake of growing those vegetables which belong to the same natural order immediately after one-another on the same ground may, as far as possible, be avoided. It may be stated, also, that it is not a good practice to grow root crops, although they may not belong to the same

natural order, after one-another on the same ground. Another important matter to be considered is the importance of avoiding the growing of any plants which are subject to serious diseases, insect or fungus, season after season on the same ground. For instance, tomatoes are very liable to a destructive fungus disease on the fruit, and the spores of the fungus are almost certain to remain on or in the ground ready to attack tomatoes next year, and so on perpetuate the disease. But if other kinds of plants are grown belonging to other natural orders this fungus can make no progress, for it will not attack them, and in course of time the spores of the fungus, which represent seeds to a certain extent in other plants, die away for want of necessary material to thrive upon. There are certain vegetables which necessarily must occupy the same place in the garden for many years, but luckily, so far, they are not subject in this Colony to any destructive diseases. These vegetables are asparagus, globe artichoke, and rhubarb.

Asparagus belongs to the natural order				*Liliaceæ.*
Globe Artichoke	„	„	„	*Compositæ.*
Rhubarb	„	„	„	*Polygonaceæ.*

In rotation of cropping these vegetables need hardly be considered until they are cleared away to make place for something else. Other vegetables in common use are as follows :—

Nat. Order, *Chenopodiaceæ* (or Goose-foot family).—Beet, spinach.

Nat. Order, *Cruciferæ.*—Cress, watercress, mustard, turnip, horse-radish, sea kale, cauliflower, cabbage, broccoli, brussels sprouts, borecole, or kale, kohl rabi, and swede.

Nat. Order *Compositæ.*—Cardoon, chicory, endive, Jerusalem artichoke, salsify (or salsafy), lettuce.

Nat. Order *Umbelliferæ.*—Carrot, celery, carraway, parsley, fennel, samphire, parsnip, chervil, dill.

Nat. Order *Liliaceæ.*—Onion, leek, chive, garlic, shallot, asparagus.

Leguminosæ.—Beans of all sorts, peas of all sorts, earth or ground nuts.

Nat. Order *Cucurbitaceæ.*—Cucumber, gourds, pumpkin, melon, vegetable marrow, squash, luffa.

Nat. Order *Solanaceæ.*—Potato, egg-plant, tomato, capsicum, Cape gooseberry.

Nat. Order *Gramineæ.*—Sweet maize, pop-corn.

Nat. Order *Convolvulaceæ.*—Sweet potato.

Chicks Dying in the Shell.

In answer to inquiries submitted by Mrs. F. Probje as to the reason why chickens and ducklings fully matured in the egg die before being able to get out, Mr. J. J. McCue, Poultry Expert at the Hawkesbury Agricultural College, says :—" This has been a widespread complaint this season, and is one of those things that cannot be accounted for

with certainty. It happens in incubators as well as in this case—the hens and ducks sitting close—yet with all the proper natural conditions for a perfect incubation, the eggs fail to hatch properly. In England and America, the hatching results have been the worst for years, and for the months of June, July, and August, have been anything but good in this Colony. As to the cause—'tis one of the things I don't know—I have experimented, and am still doing so, to try and find out the cause. Many times I have thought I had found out, but when tested further, I would find I had not. I will be only too pleased to give the cause and remedy, if I am successful in this season's experiments."

Mr. Samuel Ellis, of Botany (whose large duck farm formed the subject of an article in this *Gazette* last December), in a letter to the *Daily Telegraph,* 21st October, 1899, writes:—

Some time ago I complained through your columns about my bad hatchings. Incubators that had previously given me as high as 98 per cent. were only hatching from 15 to 20 per cent. from fertile eggs. I determined to ascertain what was the matter. I altered the whole of my twenty-four machines, allowing some more ventilation, some none at all, others half the usual current, and so on. At last I have discovered that the fault was too much ventilation under the tank, or, in other words, too much air passing through the eggs from underneath. I now stop all the holes up underneath the tank until four or five days before the eggs are due. Then I open one hole in the middle for the remainder of the period. After the first five or six days, when the eggs have been tested, I put in the water-tray a pint of boiling water each morning, whilst turning the eggs, allowing the flap of the machine to remain down, and by the time the eggs are turned the steam has gone. In this way there is a damp atmosphere. As our machines warm their own water, this boiling water helps them. The Americans laugh at our hot water, but let those who win laugh. I find it worth the trouble, and my results have improved from 15 to 20 per cent. to 80 to 87 per cent. To me this makes a difference of hundreds of pounds. As to sprinkling the eggs, mentioned by some of your correspondents, if they were to try this plan they would not need to sprinkle. I contend that sprinkling kills more than it saves. At the same time it is the damp atmosphere, you know, which does all the good.

Dehorning Cattle.

Several inquiries have been received with respect to dehorning cattle. The following memorandum on the subject has been prepared at the instance of the Chief Inspector of Stock, by Mr. J. D. Stewart, Veterinary Surgeon to the Department:—The operation of dehorning cattle is best performed while the animals are young, when the horn-buds may be removed either by cutting out with a pruning knife or by means of a pair of bone forceps. The horn buds should be taken out cleanly, and the lacerated surfaces dusted with powdered boracic acid, after which stockholm tar may be smeared on. The actual cautery and severe caustics are often used to destroy the horn buds; but unless carefully and skilfully applied they are likely to cause the animal severe and unnecessary pain. The dehorning of adult cattle is always accompanied with pain. The horns are sawn off or cut through by means of a special cutter. When dehorning is considered necessary in aged cattle, the horns should be removed at their base. Tipping is unsatisfactory, while half dehorning is decided cruelty.

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society	A. B. Chippindall	Jan. 11, 12
Lismore A. and I. Society	T. W. Hewitt	,, 18, 19
Gosford A. and H. Association	W. McIntyre	,, 20, 21
Kiama Agricultural Association	J. Somerville	,, 25, 26
Wollongong Agricultural Association	J. A. Beatson	Feb. 1, 2, 3
Moruya A. and P. Society	J. Jeffery	,, 7, 8
Manning River A. and H. Association	W. Plummer	,, 9, 10
Liverpool Agricultural Society	J. E. Wilson and G. L. Sutton, Hon. Secs.	,, 9, 10, 11
Berrigan Autumn Show	R. Drummond	,, 15
Ulladulla A. and H. Association	C. A. Cork	,, 15, 16
Lithgow A. H. and P. Society	M. Asher	,, 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society	E. H. Sargent	,, 17, 18
Tumut A. and P. Association	M. McNamara	,, 22, 23
Alstonville A. Society	N. R. Elvery	,, 22, 23
Port Macquarie and Hastings A. and H. Society	J. Y. Butler	,, 23, 24
Bega A., P., and I. Society	John Underhill	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes)	John Priest	,, 1, 2
Robertson Agricultural and Horticultural Society	R. G. Ferguson	,, 2, 3
Upper Murray (Tumbarumba) P. and A. Society	W. Willans	,, 7, 8
Tenterfield Intercolonial P., A., and M. Society	T. W. Hoskin	,, 7, 8, 9, 10
Cudal A. and P. Society	C. Schramme	,, 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood	,, 8, 9
Oberon A. H. and P. Association	Alfred Gale	,, 9, 10
Berrima District (Moss Vale) A., H., and I. Society	H. Richardson	,, 9, 10, 11
Castle Hill and District A. and H. Association	F. H. Rogers	,, 10, 11
Cobargo A., P., and H. Society	T. Kennelly	,, 14, 15
Southern New England P. and A. Association (Uralla)	P. M. O'Connor	,, 14, 15
Inverell P. and A. Association	John McGregor	,, 15, 16, 17
Nepean District (Penrith) A., H., and I. Society	E. K. Waldron	,, 16, 17
Gundagai P. and A. Society	A. Elworthy	,, 16, 17
Goulburn A., P., and H. Society	J. J. Roberts	,, 16, 17
Candelo Agricultural Association	C. H. Brooks	,, 16, 17
Cumnock P. A. and H. Association	W. L. Ross	,, 17, 18
Walcha P. and A. Association	F. Townshend	,, 21, 22
Blayney A. and P. Association	H. Woolley	,, 22, 23
Upper Hunter (Muswellbrook) Agricultural Society	J. C. Luscombe	,, 22, 23, 24
Camden A., H., and I. Society	C. A. Thompson	,, 22, 23, 24
Bangalow A. and I. Society	John R. Wilson	,, 23, 24
Crookwell P. and A. Association	M. P. Levy	,, 23, 24
Warialda P. and A. Association	W. B. Geddes	April 5, 6
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Mudgee Agricultural Society	J. M. Cox	,, 11, 12, 13
Cooma P. and A. Association	C. J. Walmsley	,, 12, 13
Clarence P. and A. Association	Jas. C. Wilcox	,, 13, 14
Lower Clarence Agricultural Society (Maclean)	G. Davis	,, 18, 19
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Hunter River A. and H. Association	W. C. Quinton	,, 19, 20, 21
Orange A. and P. Association	W. Tanner, jun.	April 26, 27, 28
Wellington P. and A. Society	R. Porter	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	....	,, 4, 5
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Dubbo P. A. and H. Association	H. Munckton	,, 9, 10
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Mudgee Agricultural Society	J. M. Cox	,, 16, 17
Walgett P. and A. Association	Thos. Clarke	,, 17, 18

Society.	Secretary.	Date.
Durham A. and H. Association	C. E. Grant ...	May 17, 18
Deniliquin P. and A. Society	H. J. Wooldridge	July 19, 20
Moree P. and A. Society	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Association...	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association	N. A. Read ...	,, 1, 2
Parkes A. and H. Association	J. H. Lane ...	,, 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Society	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
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Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Moama A. and P. Association	C. L. Blair ...	,, 13
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Germanton P. A. and H. Society	G. T. S. Wilson	,, 20, 21
Yass P. and A. Association...	W. Jermyn ...	,, 21, 22
Temora P., A., H. and I. Association	W. H. Tubman	,, 27, 28
Burrowa P. A. and H. Association	F. H. Tout ...	,, 28, 29
Queanbeyan P. and A. Association	A. W. Moriarty	,, 28, 29
Holt-Sutherland H. and P. Society (Miranda)	E. Thacker ...	October 2
Berry A. Association	A. J. Colley ...	Dec., 6, 7, 8

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Dapto A. and H. Society	A. B. Chippindall	Jan., 10, 11
Albion Park A. and H. Association	H. Tryer ...	,, 17, 18
Wollongong Agricultural Association	J. A. Beatson	,, 31, Feb., 1, 2
Alstonville Agricultural Society	N. R. Elvery ...	,, 14, 15
Robertson A. and H. Society	R. J. Ferguson ...	,, 29, Mar. 1
Cobargo A. P. and H. Society	T. Kennelly ...	Mar. 1, 2
Tenterfield I. P. A. and M. Society, Show	T. W. Hoskin ...	,, 6, 7, 8
,, ,, Fair days	,, ...	,, 9, 10
Oberon A. H. and P. Association	Alf. Gale ...	,, 8, 9
Campbelltown A. H. and I. Society	A. R. Payten ...	,, 9, 10
Lismore A. and I. Society	T. W. Hewitt ...	,, 7, 8
Bega A. P. and H. Society...	J. Underhill ...	,, 14, 15
Central New England (Glen Innes) P. and A. Assoc. ...	John Priest ...	,, 14, 15, 16
Nepean District A., H., and I. Society	E. K. Waldron...	,, 14, 15, 16
Cumnock P., A., and H. Association	W. L. Ross ...	,, 20, 21
Armidale and New England P., A., and H. Association	W. H. Allingham	,, 20, 21, 22
Mudgee Agricultural Society	J. M. Cox ...	,, 21, 22, 23
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Liverpool Plains P., A., and H. Association (Tamworth)	J. R. Wood ...	,, 27, 28, 29
Clarence P. and A. Society (Grafton)	J. C. Wilcox ...	,, 28, 29
Blayney A. and P. Association	H. Woolley ...	,, 28, 29
Gundagai P. A. H. and I. Society	A. Elworthy ...	,, 29, 30
Castle Hill and District A. and H. Association... ...	F. H. G. Rogers	April 4, 5
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Orange A. and P. Association	W. Tanner, junr.	,, 4, 5, 6
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* Entries close 20th April.

[14 plates.]

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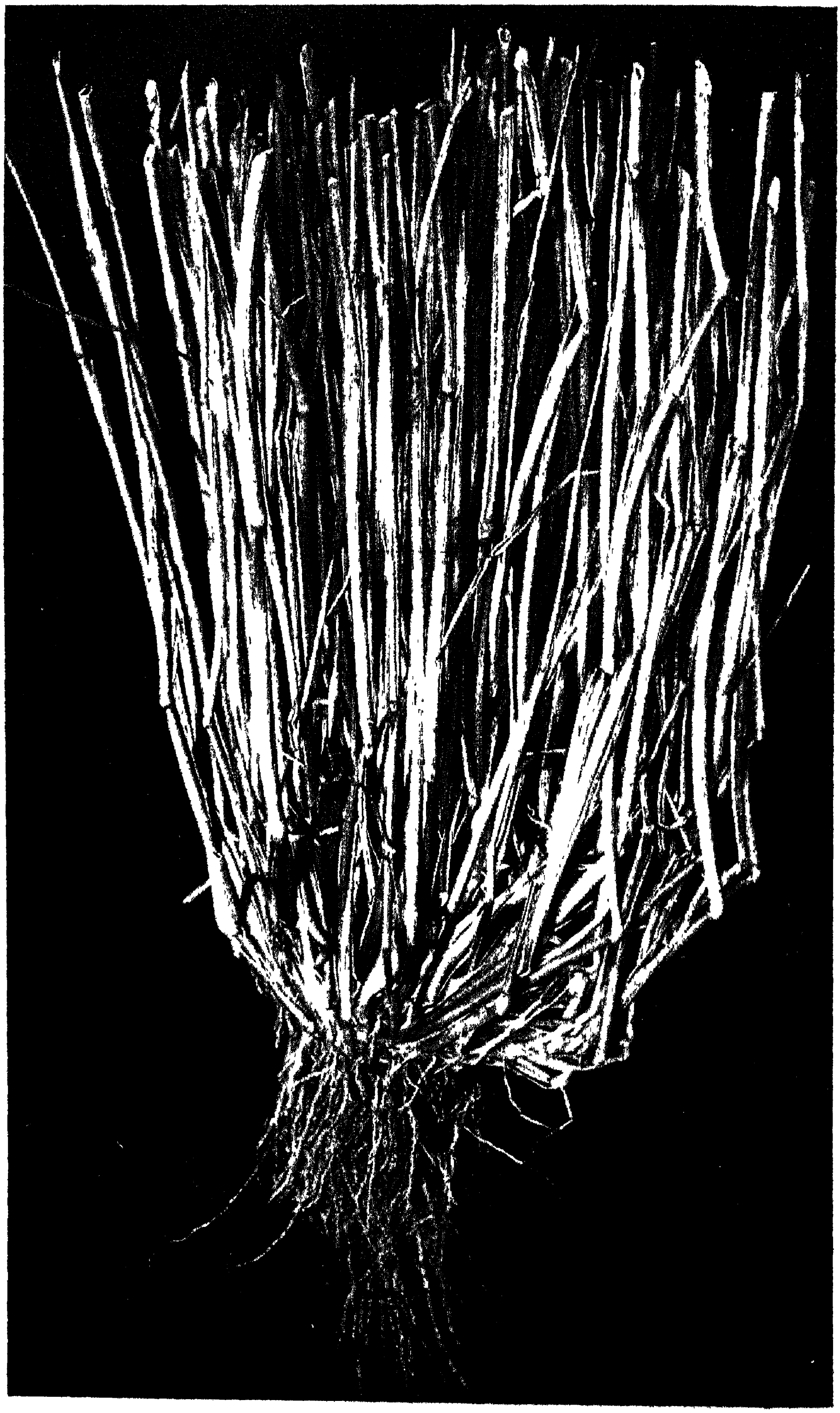


A Stool of Steinwedel Wheat grown at Blairmore, Boggabri.

The Tillering or Stooling Proclivities of Wheat.

J. L. THOMPSON,
Government Agricultural Instructor.

IN Agricultural phraseology the terms "stooling" or "tillering," mean the production of a large number of stalks from a single seed.

Shortly after the stem appears above ground, it commences to throw out new and distinct stems, upon the first appearance of each of which a corresponding root bud is developed for its support; and while the new stems grow out flat upon the surface, their corresponding roots assume a corresponding development below the surface. This process called tillering or stooling continues until the season arrives for the stem to rise to an upright position, after which the vital power of the plant is concentrated upon the production of the ears. It will be seen how very important it is to sow wheat early, so as to give it plenty of time to tiller and develop abundance of root growth. In order to allow the wheat plant to tiller as it ought to do, it should be sown very much thinner than it generally is. There are, on an average, about 800,000 seeds in an Imperial bushel of wheat; this allows 158 seeds to a superficial square yard, or about 17·5 to a square foot.

Now, I ask any sensible man if there is room for 158 fertile seeds to develop as they ought to do in the small space of a square surface yard. Nothing of the sort. One plant crowds out the other; a struggle commences almost at once for existence; one plant robs the other, with the result that a puny little plant is developed, producing miserable heads, and shrivelled, ill-developed grain. And yet we hear of farmers sowing wheat at the rate of 1 bushel, 1¼ bushels, and sometimes even 1½ bushels to the acre. Advanced farmers, however, are now recognising the wisdom of sowing much thinner than formerly. The very best crops I have seen this year were sown with the drill at the rate of 20 and 25 lb. of seed per acre. The illustration shows a stool of wheat grown on the farm of Mr. Alexander Crawford, J.P., Blairmore, Boggabri. I pulled it myself, on the 9th instant, in a field of Steinwedel wheat sown with the drill at the rate of 25 lb. of seed per acre. The plant was growing on a spot that had been partly missed, thus giving it full space for development. There are 125 stalks which produced 125 perfect heads, with an average of fifty grains on each head, thus giving the enormous return of 6,250 grains from one single seed.

While lecturing at Nemingha, my attention was drawn by Mr. Chas. W. Coombe to four stools of wheat, the product of four single grains, and containing 112, 120, 120, and 146 straws per stool; total 498 straws. This excels the best records in Europe.

Major Hallett produced a barley-plant which had 110 stems, and something like 5,000 to 6,000 grains from one single seed.

A wheat-plant with 105 heads growing on one root, on which more than 8,000 grains were produced, was exhibited in 1876, at the Maidstone Farmers' Club. At the Wagga Wagga Farm, Mr. Valder averaged 40 bushels of wheat to the acre, from 4 lb. of seed, and, I believe, if we had a machine which could sow that quantity with mathematical accuracy over an acre of land it would be ample seeding, if all fertile. The difficulty is in getting a machine capable of sowing this quantity. There is now a splendid opportunity for the inventive mind to produce such a machine. There is nothing really new in thin sowing. Mr. J. J. Michie, of Tiptree Hall, England, about the year 1848, obtained the enormous yield of 80 bushels of wheat from an acre of land sown at the rate of 10 lb. of seed. It has been said that Mr. Michie's agricultural operations were unprofitable, but this was contradicted by his daughter in a letter which appeared in the columns of a leading English newspaper, which stated that her father's agricultural operations were always profitable, and that his financial collapse was caused through his connection with a financial institution. My own experiments, extending over a period of thirty years, have always been in favour of thin sowing. The richness and general condition of the soil must always be taken into consideration in defining the quantity of seed; the richer the soil, and earlier the crop is put in, the less seed is required. The poorer the soil, and the later the seed-time, the more seed required. The above remarks apply to seeding for grain, not for hay purposes.

Lemon Curing.

The *Californian Fruit-grower* gives the following account of the method of lemon curing followed by Mr. C. W. Buswell, a successful grower and shipper in that state :—

The lemons are always picked carefully in the autumn; but only those that are green are stored. The coloured ones he ships at once. He next places them in boxes 16 inches wide, 10 deep, and 24 long. He fills the boxes with these so that the box which is placed on top will not rest on any of the lemons below. No later than the next day he places them in a cellar which is dug in the ground, the size being according to the space required. One top ventilator is all that is necessary, and there should be no others to cause a draught with the exception of a door, which should be open at night, when the temperature should not be over 60 degrees Fahrenheit. The cellar should be kept perfectly dry. The boxes should be stacked close together to avoid the circulation of what air there is. The lemons are rarely sorted over if kept according to above directions. The rind is not thicker than one-eight of an inch all through, and under the above-described treatment is as smooth as a glove, and the lemons are as firm as the day they were picked off the tree.

Hay-making.

R. W. PEACOCK.

At this season of the year a few practical notes upon the above may prove of value to beginners who have not as yet learned the art. If successful practical men could be induced to pen their opinions upon this subject and send them to the *Gazette*, many experiences too dearly purchased by the novice would not prove so disastrous, and the farming community generally would materially benefit. With this object in view I pen these notes, and trust to see them supplemented in future issues by more from other practical men. It would be difficult, owing to climatic differences, such as temperature, humidity, &c., to lay down rules for general observance; such I do not attempt, but purpose merely to give a few hints which have occurred to me during my own farm operations.

Lucerne.

This crop is one of the most difficult to cure properly, and requires a great amount of attention, in moist as well as in warm climates. No crop deteriorates more under careless handling than this one; the inferior samples very often sold in the Sydney markets are due, in many instances, to want of sufficient care in the making. It should be cut just as the first blossoms appear, as at this time the lower leaves begin to turn yellow and fall off. If left longer the product will become stalky and inferior. The cutting should be done in narrow strips; the piece commenced before noon should be cut out, if possible, before knocking off, to allow of its wilting evenly. The horse-rake is run across the swaths, which allows of its being picked up clean, and the leaves are not knocked off so much by the stalks running between the teeth of the rake. If the crop is very heavy it may need turning over in the swath, to allow the sun to dry it uniformly, especially if the ground is damp, or otherwise the crop nearest the ground would turn yellow. It should be raked into windrows whilst sufficiently tough to prevent loss of leaf during the process; then make it into cocks—if rather green into small, and if dry into larger ones. If lucerne is cocked too green it will go mouldy. The small cocks present a larger surface to the bleaching effects of dews, and colour is thereby lost; they possess the advantage of drying quicker in uncertain weather, and can be carted sooner. If fine weather can be relied upon, better hay can be made by making large ones; a smaller proportion will be parched and bleached, but it will require more field-room. In moderate climates, during most favourable weather, lucerne cannot be properly made under four days, and in

unfavourable weather it would take much longer. When it is fit to cart no time should be lost before stacking. It can be carted greener if the stack is to be a small one, but if a large one it must be well cured, or otherwise it will sweat and turn brown, thus destroying the green colour which is of such importance in the market. If, as so often happens in the spring time, the weather prevents proper curing, small narrow stacks should be made, as loss from heating is thereby minimised. These stacks should be about 4 yards wide, and placed with the ends to the most drying quarter, or the unequal drying of either side might cause them to lurch out of plumb. When the hay clings to the fork and the fork gums, it is too green to cart. The first cut of lucerne is very often hard to cure properly on account of the weather, as also is the last one, but in many instances good hay is spoilt by allowing it too much sun, and the hay is very often stalky and leafless. Well-cured lucerne hay is fine in the stalk, leafy, of a perfect green, and of a pleasant odour. Some people, it might be added, prefer brown hay; but so far as market records go, perfectly cured, fine, silky-stalked, green hay, with abundance of leaf, fetches top price.

Oaten Hay.

The quality of oaten hay depends upon the variety of oats grown, as well as upon the method of curing. Many varieties have coarse straw, which adapts them for chaffing purposes, coarse hay being easier to cut, and produces a better sample of chaff. The thin straw varieties are more suitable for the prime oaten hay which is in such demand for race-horses, and, if properly cured, demands about £1 per ton more in the market. As most of the hay grown at the present time is eaten as chaff, the attention is not given to high-class products. But it will always pay the farmer to take care in the curing of his hay for chaffing purposes. Colour is most important, and can best be gained by cutting just as the crop is full grown, allowing it to wilt slightly, and raking before it is exposed to dews or rains. It should then be made in rather large cocks, and allowed sufficient field-room to prevent its heating when stacked. This hay can very rarely be carted safely under four days during the very driest weather, and if the conditions are not favourable for drying eight or ten days may often be required. The most economical method of haymaking is with the aid of the string-binder, it making better chaff when sheafed, being free from dirt, and cutting a better sample. Care must be taken not to cart it too green, or the sheaves heat badly at the bands, thus spoiling the colour of the chaff. The smaller the sheaves the sooner it will dry, and the stooks should not be made too large. It takes much longer to cure than loose hay, and, if cut green, in average haymaking weather, should be left out a fortnight. A great amount of sheaf hay is damaged by being carted too soon. In very dry climates hay makes very much quicker, and it often proves troublesome when being chaffed by its being too dry. The straws split into narrow fragments whilst being cut, spoiling the appearance, which makes the chaff sell considerably under the same coloured, made from

tougher hay in cooler climates. To minimise the loss from such causes, the stack should be steamed before cutting, by means of a tube attached to the engine, with a sharpened perforated pipe at the end to thrust into the stack. This toughens the hay, which can then be chaffed satisfactorily.

Wheaten Hay.

Wheat should be cut for hay whilst perfectly green, for, if left later, the straw loses colour and digestibility, which more than counterbalances the supposed benefit of possessing grain. Wheaten hay is invariably cut into chaff, as feeding as hay is most wasteful. It is thus better to sheaf it; and the remarks upon the making of oaten hay are applicable to this. There are many varieties suitable for hay, the long, strong, strawed ones yielding the greatest amount per acre, and, as they are mostly chaffed, fine straw is of no importance. Cereal hays are almost always chaffed, it being much more economical, the stock not being able to pick the most palatable pieces and reject the worst. Chaff should not be cut too fine, or otherwise the stock are apt to bolt it, instead of chewing, half an inch being quite short enough.

Many of the above remarks cannot be generally applied, as different treatment is necessary under dissimilar conditions, and, as before stated, such conditions are subject to great variations.

Cut-Worms in Tomatoes.

A few weeks ago, Mr. T. R. Archbold, who is an extensive grower of tomatoes at Narara, wrote to the Entomologist for advice as to the best means of getting rid of cut-worms, which were destroying his crop.

Mr. Froggatt recommended the use of Paris green—½ oz. Paris green, 1 oz. sugar, and 1 lb. bran, well mixed and made into a paste. Small pellets of this were to be placed among the plants.

Mr. Archbold obtained a pound of Paris green, and tried it as advised. Writing about the results he says:—"The mixture was very successful, for it destroyed the grubs wherever it was placed."

Bull for Sale.

Attention is directed to the advertisement in this issue with respect to the Jersey Bull, "Coral's Lad," now at Bathurst Farm.

Caterpillars.

The Bugong Moth (*Agrotis infusa*, Boisd.)

By WALTER W. FROGGATT,
Government Entomologist.

Though great numbers of the caterpillars of this moth were forwarded to the Department, and a great many more collected, placed in the breeding-cages, and carefully fed, it was not until the middle of October that any specimens of the perfect moths were obtained, so that the species could be determined. On the 12th three moths emerged from a cage containing a number that had been collected by Mr. J. J. Strickland and myself near Forbes, and which did not appear to have been attacked by the prevailing fungoid disease; yet from some forty caterpillars, only these three ever came to maturity.

This moth is one of the best-known species in Australia under the name of the "Bugong Moth," which in old times formed an important food for the natives of the Tumut district. The blacks used to ascend the Bugong Mountains and collect them in thousands among the openings in the granite rocks, by sweeping them into bags. These moths were afterwards roasted on the hot ashes, and eaten with great relish by the blackfellows. A very interesting account of his visit to these mountains was given by Scott in the "Transactions of the Entomological Society of New South Wales in 1867."

In the first volume of this *Gazette* the late A. S. Olliff gives this moth as a maize pest, and says that "there is not the least doubt that this is the moth which appeared in such vast numbers in Sydney and elsewhere in October, 1889, and years before in 1867."

This moth is figured by Mr. Olliff, together with specimens of the American Boll worm (*Heliothris armigera*), under the old name of *Agrotis spina*, Gn.

The immense range of country from which these caterpillars have been recorded during the last season is very remarkable. Commencing below Moree in the north, they were very destructive at Barraba, Manilla, Boggabri, Breeza, Gunnedah, and Wingen; again we received them from Mudgee, Dubbo, Molong, Parkes, and Forbes; from the south they were sent from near Blayney, Cootamundra, Yass, Gundagai, Narrandera, and all round Albury and Corowa; and there are probably many other places where they were equally destructive, but of which we received no notice. In all probability they could have been found right across the country.

It is well known that each moth can lay up to 1,000 eggs, of which, under ordinary circumstances, only a small percentage would hatch out; but it is quite evident that last season's climate must have suited them, for the larvæ were in immense numbers. It is quite natural that people wonder why they did not see the moths before the

caterpillars appeared, but I have two records of my having seen immense numbers of the moths the previous summer. On the 17th October last year, when driving from Bowning to Yass, late in the evening, I passed a number of small gum-trees (Eucalyptus) covered with blossom, round which thousands of these moths were flying like a swarm of bees. In November of the same year, from Manly to Freshwater, on the Narrabeen road, the bushes (*Leptospermum* and *Melaleuca*) were enveloped in countless swarms of this moth for several miles along the roadside.

It was noticed that in every district where the country is undulating the caterpillars did a great deal more damage in the black soil flats than upon the red soil. There are probably two reasons for this. In the first place the food on the flats is much more abundant and soft, being composed of trefoil, weeds, clovers, and light herbage, while the soil is loose and full of cracks, into which the caterpillars can crawl. In the second place, judging from the appearance of their tracks, the eggs were laid in the flats. The red soil is very hard land, with short tufty grass, so that not only is the food not so suitable, but it is also a matter of difficulty to the caterpillars to gain any shelter in the ground, and they fall easy victims to their numerous enemies.

The following field-notes are of interest:—I drove out from Narrabri to the Black Hills, about 15 miles north on the Moree-road, where we first struck the caterpillars, a space of about a mile square having been eaten off so clean that it looked as if it had been burnt. We could find no caterpillars on the lower portion; but, driving across to the eastern edge of the denuded land, we found a regular fringe of full-grown, olive-green caterpillars feeding in a south-easterly direction. On turning over the soil with a knife we found, on an average, six large caterpillars and several small ones covered just under the cracked surface of every square foot of soil. In a small crop paddock near Narrabri another small army had taken possession, eating all one side of the wheat clean off. The owner said that they had first appeared in a small vegetable garden, but they did not appear to travel outside the paddock.

At Gunnedah, commencing close to the town, the caterpillars swept the road towards Breeza of every green blade, spreading into Mr. Godwin's station paddocks on either side, running up the valley without touching the red soil of the hills, so that the land looked as if it had been ploughed and left to fallow, thousands of acres being cleared in this manner.

In the Forbes district, later on, through the kindness of Mr. J. J. Strickland, I had the opportunity of noting them upon some large areas of wheat, large strips being eaten off, while blocks on both sides were untouched.

The report that the caterpillars ate the wheat grain as well as the shoot was investigated, with the result that it was found that though the caterpillar did not actually eat the grain, yet if, as had been the case in several places, the frost came when the young wheat had been gnawed down close to the seed and no rain followed, the impoverished grain soon after rotted in the soil.

Here upon the grass land, but seldom if ever among the crops, another caterpillar was found in great numbers, and was subsequently sent from Wagga, Yass, Junee, and a number of southern stations to the Entomological Branch.

Unlike the plague caterpillar, this species is shorter and broader, and thickly covered with dark hairs, variegated with yellow; the head broad, and marked with reddish lines. Though no specimens have yet been bred, there is little doubt that this is the larva of a well-known "grass moth" (*Apina callestro*), as great flights of these moths were noticed in several localities early in the summer, and were in no way related to the first-named caterpillar.

Description and Life History (*Agrotis infusa*).

The caterpillars are of the usual elongate oval form, attaining an average length of about 2 inches when full grown, smooth and hairless, with the sides striped, and varying in colour from pale olive-green to dull black; after undergoing a series of moults they bury themselves in the ground and pupate, changing into a smooth, dark-brown, oval, elongate chrysalid, without forming any cocoon, and simply enclosed in an earthern chamber.

Moth.—The perfect insect is of the usual stout, broad, short-winged form, common to the Noctuid moths, measuring 1¾ inches across the outspread wings, and the body about ¾ inch. The head, thorax, and abdomen thickly clothed with dark-brown down, some finer hairs forming an irregular transverse bar across the head, and the sides and tips of the abdomen thickly fringed with darker down. The antennæ are long and slender, and finely toothed in the males; more hair-like in the female specimens. The fore-wings thickly clothed with dark-brown scales, the outer edge slightly mottled along the centre of the costal nervure, and the tips finely marbled with irregular transverse bars; down the centre of each wing is a slender short black stripe, on which are two oval greyish-brown spots, the inner one heart-shaped, the lower one oval and smallest. The hind wings are light brown with the inner tip blotched with blackish-brown, which, in a lighter tint, runs round the wing; the under surface of the wings with a coppery metallic sheen.

Australia is not alone in its troubles with these armies of caterpillars, one species, *Lucania unipunctata*, which has a cosmopolitan range, being found in this country, as well as in the United States, Canada, and India, is known as the Army Worm. Speaking of this pest, Professor Webster (Ohio Exp. Station Report, *Bull.*, 96, 1898) says: "In Ohio, in 1861, it did an immense amount of damage; again in 1875, and in 1896; but there is no record of them appearing in any numbers two years following. Though in their natural state they are true grass-eating caterpillars, they will destroy well-grown wheat and oat crops, even after it has been cut for hay in the field.

In India it is recorded as a very destructive pest to paddy and oat crops. Speaking about their habits, Mollison (Indian Museum Notes, vol. iv, No. 4, 1899) says: "They are not 'cut' worms. They feed

at night, crawl up the stems, and are found in colonies, five to twenty in a lot, lightly covered with soil in the driest parts of the soil surface during the day."

Remedies.

When these caterpillars first appear, and before they have grown into a formidable enemy, is the proper time to attack them, and if prompt measures be taken as soon as they are noticed in any particular locality, it would be very much easier to check or confine them to a limited area than to stop them when once they have commenced to travel. From what we know of this year's plague, it is evident that the eggs are deposited on the grass or soil on the black-soil flats, and if a look-out be kept by running an under-cut plough furrow round them, so that the vertical side face outwards, the caterpillars fall into the furrow, and being unable to crawl up, they naturally follow it down. If at intervals a circular pit-hole about a foot deep, with clean-cut sides, be sunk in the furrow, the wandering caterpillars will fall in, and being unable to get out, they eat each other. To make certain of every one, the holes could be visited every day, and the contents treated. This was tried with great success near Forbes this season; and where the caterpillars are feeding off the grass lands towards a crop paddock, if taken in time and done carefully, hardly a single caterpillar would find its way into the wheat. Farmers may say that this is a lot of trouble to go to; but it is not so expensive or annoying as having to re-sow the paddock again, with the chance that there are still many immature caterpillars in the field.

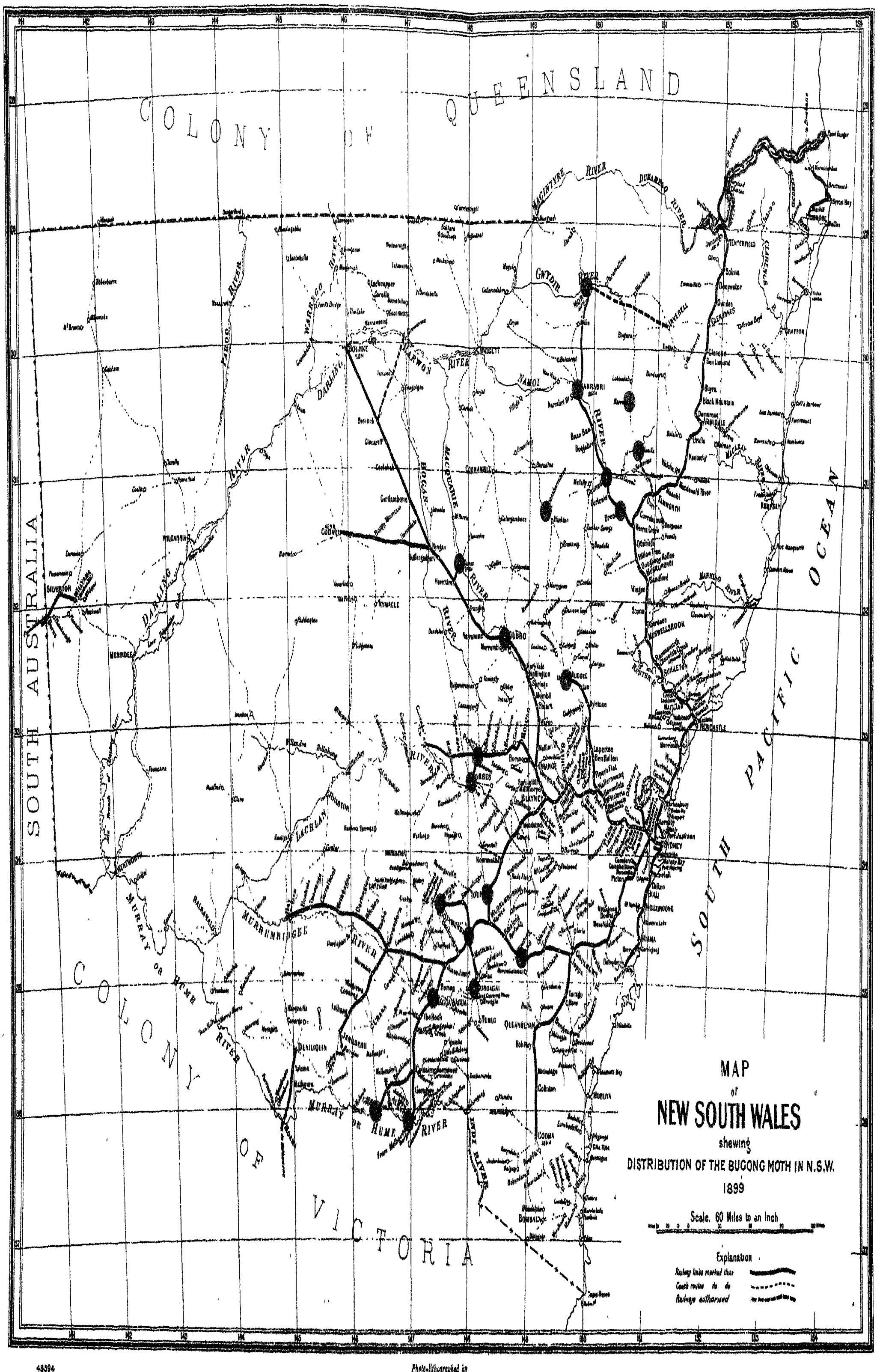
When the caterpillars are crossing the hard ground, a bundle of brush with a weight upon it, dragged up and down, would kill a large percentage, while a flock of sheep driven close together would also injure and trample numbers.

Spraying a strip of land with a solution of Paris green (1 lb. to 150 gallons of water) could only be effectively done along the head-land of a crop paddock.

A number of farmers, when they found the caterpillars in their crop paddocks, set to work and rolled them several times, and this not only killed a great number when done in the evening, while the grubs were feeding, but it closed up the cracks in the ground, and thus protected the wheat stalk from their attacks. It was found that in short crops farmers could not roll early in the morning, as the dew stuck the young wheat to the roller and pulled it out.

Fungoid Disease.

As stated in reports previously sent in, and noted in the *Agricultural Gazette*, I discovered, during my investigations on the life-history of the caterpillars, that a fungoid disease was destroying immense numbers of them. This was first noticed at Boggabri, then at Gunnedah, and again all round Forbes. This fungoid disease appears to attack the caterpillars when they have attained full growth, and it is probably accelerated by the immense numbers of them crawling over and fouling the grass upon which they are feeding. When the caterpillars are



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Useful Australian Plants.

By J. H. MAIDEN.
Government Botanist and Director of the Botanic Gardens, Sydney.

No. 55. *Apluda mutica*, Linn.

Botanical name.—*Apluda*, Greek for chaff, the inflorescence resembling chaff in appearance; *mutica*, Latin, blunt, perhaps in allusion to the outer glume.

Synonym.—All species of *Apluda* are reduced by Hackel to forms of *A. varia*, Hackel.

Where figured.—Duthie (sect. figure).

Botanical description (B.Fl., vii, 544) :—

Stems creeping or climbing, several feet long, with erect branching flowering shoots.

Leaves long, usually glabrous.

Panicle loose and leafy, 1 foot to 2 feet long.

Bracts subtending the spikelets 3 to 4 lines long, very concave, striate, with short, sometimes awn-like points, in clusters of five or six.

Sessile spikelet shorter than the bract.

Pedicellate spikelets either reduced to a rudimentary glume or more developed and protruding beyond the bract.

Awns of the terminal glume very minute or entirely deficient.

Value as a fodder.—So little is known of the economic value of this *Apluda* that the following note on an allied species (*A. aristata*)* is interesting :—"In hedges and bushy places it usually assumes a climbing habit. In forest land it often constitutes a large portion of undergrowth. It is considered to be a fairly good fodder grass, and is readily eaten by cattle when young." (Duthie.) Its close affinity to kangaroo grass (*Anthistiria*) renders it extremely likely that this is a useful grass.

Habitat and range.—Found in New South Wales and Queensland. In our Colony, found only in the interior, but rare, and worthy of the best attention of collectors. Found also in Asia, Africa, and the Pacific Islands.

REFERENCE TO PLATE.

A. Part of Panicle.

B. Triplet of Spikelets.

C. 1, Empty outer glume; 2, 3, pedicellate barren spikelets; 4, fertile spikelet; 5, terminal glume of fertile spikelet.

D. Grain.

* Really a form of the same species, according to Hackel.

No. 56.—A Three-pronged Spear-grass.*—*Aristida arenaria*, Gaud.

Botanical name.—Aristida, already explained; *arenaria,* Latin, belonging to sand—*i.e.*, growing in sandy, sterile places.

Botanical description (B.Fl., vii, 561).—Very near *A. stipoides,* and reduced to that species by F. Mueller, *Fragm.*, viii, iii, but a smaller plant; the

Stems usually not above 6 inches below the inflorescence, rarely slender, leafy, and nearly 1 foot long.

Leaves much finer, almost filiform.

Panicle narrow and spikelike, scarcely branched, or more frequently reduced to a simple raceme, 3 to 4 inches long, without the awns.

Outer glumes very narrow and fine pointed, usually dark coloured, the lowest nearly ½ inch long, the second, ⅜ inch.

Flowering glume rather smaller than in *A. stipoides,* the awn under 1 inch and usually ½ to ⅜ inch below the branching, the branches very fine, varying from 1 to 3 inches.

Value as a fodder.—A dry, wiry grass, bad for sheep on account of its sharp awns, becoming sharp when old, and only useful for fodder when young.

Habitat and range.—Poor, sandy, or sour land, in all the colonies except Tasmania. In New South Wales it is confined to the dry western districts.

Reference to Plate.

A. Portion of inflorescence (natural size).
B. Three-pronged awn (enlarged).
C. Outer glumes.
D. Part of awn, showing its offensiveness as a weapon to pierce the skin of sheep.
E. Seed.

* For a note on the torsion of seeds of *Aristida* and *Stipa*, see *Nature*, xv, 374.

Burning Weeds.

It is a mistake to let weeds go to seed in the garden or around the farm, under the impression that they can be destroyed if gathered in the fall and burned. In the first place, the job is apt to be forgotten until most of the weed seeds have been scattered. Even if a weed is burned its seeds may not be destroyed, unless a hot fire of brush is first made and the weed seeds are thrown on a mass of burning coals. If weeds are piled in heaps they burn slowly, and, as the seed falls to the ground it is protected from burning by the stratum of carbonic-acid gas that is found at the bottom of all slow-burning fires.—*American Cultivator.*


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Effects on Cattle of Eating Macrozamia Roots.

[Previous reference, *Gazette*, January, 1897, p. 20.]

J. H. MAIDEN.

A FEW weeks ago I was discussing "rickets" in cattle with a prominent squatter who had had unfortunate experience with Macrozamias, for such is the botanical name for blackfellows' potatos and burrawangs. They induce "rickets" in stock, and the trying part of it is that stock get into the depraved habit of eating them, even if good feed be available. This squatter, during the winter of 1895, went to considerable expense in eradicating Macrozamias from a very large paddock. The plants, leaves, and roots were left lying on the ground. In 1896 stock were put back again into the paddock, and in six weeks stock (previously unaffected) were affected badly with "rickets." Some of them were opened and their stomachs were found to be full of dried Macrozamia leaves. He closed the paddock to cattle for another twelve months, readmitted them and similar injurious effects occurred right up to April, 1898. During the three years the strewn-about leaves had finally disappeared, and cattle are eating the roots which are turnip-like in appearance, and which have been lying on the surface of the ground for the period stated. The effects of the roots on stock appear to be similar to those of leaves. The unfortunate stock-owner thought he had cleaned his paddock when he had dug up all his Macrozamias by the roots. From what I have stated it is obvious that this is insufficient, as they must all be burnt—leaves, roots and all.

It seems sufficiently extraordinary that cattle should eat dried Macrozamia leaves, years old, exposed to all weathers; but it seems even more extraordinary to find stock eating the roots of this plant, a taste that can only have been acquired at a recent period, as Macrozamia roots are rarely removed and left lying in paddocks. I would ask my readers whether the eating of Macrozamia roots (whether accompanied by injurious effects or not) is new to them; it certainly was new to me. If any grazier chooses to give particulars of his experience, neither his own name nor that of his property will be published unless he expresses a wish to the contrary effect.

Report on Colonial Timbers to be used as Wine Casks.

By L. FRERE,
St. Hilaire Vineyard, Thurgoona.

In March, 1897, a consignment of Colonial timbers was sent to me by the Department of Agriculture, to be tried as to their suitability to be used for casks for storing wine.

Four sorts of timber were sent, namely, Cudgerie (*Flindersia australis*), Silky Oak (*Grevillea robusta*), White Beech (*Grevillea Leichhardtii*), and Blackbutt (*Eucalyptus pilularis*).

The timber arrived quite green, and could not be used for experiments of the 1897 vintage. It was stored for eight months, and kept in a shady place, and then made into eight casks, of a capacity of 500 gallons each, which were all filled up with wine of the 1898 vintage.

To determine the value of timber for wine casks, the first consideration is to see how it is suitable for cooper's work; and second, the influence of the timber on spirit when in contact with it. I had for that purpose 1 oz. of chips of each sort of timber placed in a quart of brandy, 20 per cent. overproof, and kept in maceration for two months. Thirdly, we require to ascertain the influence of the timber for bad or good on the quality of the wine stored in it. To obtain this result the casks, before being filled with wine, were steamed for six hours, and rinsed twice with cold water after steaming. After each racking the same wine was returned to the same cask, and kept in it for a period of nine months, which is quite sufficient to show any fault coming from the timber, if there be any.

Cudgerie.

Cooperage.—Timber brittle. Must be employed green; if worked dry could not be bent without breaking. Large quantity of sap wood had to be taken off. It makes casks of good appearance, and there was no leakage through porosity.

Maceration in Brandy.—After two months' maceration the brandy had very little colour, a slight agreeable aroma, and a bitter taste; it becomes of a slight whitish colour when mixed with two-thirds of water. It would be unsuitable to store brandy, but as all extracts of wood are far more soluble in brandy than in wine, I had no hesitation storing wine in it.

Wine Storage.—On 5th March, 1898, two casks of Cudgerie timber were filled with must of Verdeilho and Ancarot grapes mixed. The first racking was made at the end of April, and the same wine

pumped back into the same cask. It was racked again two months later. The wine was tasted then, and compared with a wine of same sort kept in an old oak cask; there was no difference in taste. The same comparison was repeated in September and December without any noticeable difference.

A cask of Cudgerie was also filled with red must, made of Malbec grape. The wine was strong and rough, and was not likely to show a difference of taste due to the influence of timber when a white wine more delicate had not been affected.

The strength of the wines tried in December was: White wine, 12·7 per cent. absolute alcohol; red wine, 13·2 per cent. absolute alcohol.

Silky Oak.

Cooperage.—It is very easily worked. It is the best of the four kinds for working. It makes nice-looking casks, and keeps its shape well; must be worked green or else would crack; has a little sap wood, but when full never leaked through porosity. One year after being made none of the hoops had moved; the timber did not shrink at all.

Maceration in Brandy.—The colour of brandy was still light after two months' maceration. Flavour agreeable; slightly bitter taste. When mixed with water the brandy becomes very cloudy, and forms a strong deposit of sediment. This timber would be quite unsuitable to store brandy.

Wine Storage.—Reisling and White Shiraz were used to fill two casks of Silky Oak. They were, as the wine stored in the Cudgerie, racked and returned into the same cask, so they had also nine months' storage in the same casks. After that time they were clear, and I could find no difference with wines of the same kind and age kept in other oak casks. I was afraid that the effects of the spirit getting cloudy when mixed with water should be also felt in the wine, but it was not so. The wine cleared early, and when clear and mixed with water it kept its limpidity.

White Beech.

Cooperage.—Easy to work; very soft; does not suit at all for casks. One only was made; it came quite out of shape, and the part on the stand became quite flat. Having been kept empty for a fortnight, it was with the greatest difficulty that it was made fit to hold wine again.

Maceration in Brandy.—The brandy was coloured dark; pretty strong aroma, not unpleasant; slightly bitter; becoming whitish when mixed with water.

Wine Storage.—The same red wine was kept for eight months in the cask without any difference of taste or colour compared with other wines in oak casks.

Blackbutt.

Cooperage.—Very cross-grained; very hard to work. It could not be dressed smooth. It was riddled with worm-holes, and for a long time leaked through worm-holes and through joints, not being dressed

smooth. The cooper who made the casks said that he had the greatest difficulty to work it, and even then, after very great trouble, the work was unsatisfactory.

Maceration in Brandy.—The brandy was dark in colour, good aroma, and good taste, not bitter, like the other timbers. Mixed with water the brandy keeps clear, and forms no sediment.

Wine Storage.—One cask only was made of blackbutt; it was filled with wine of black shiraz, and the wine returned to the same casks after each racking. No strange taste could be noticed in the wine.

In fact, the four timbers experimented have communicated no strange taste to the wine stored in them during nine months.

Two of them, the silky oak and cudgerie, can easily be worked, and make good casks. White beech is absolutely unfit, and blackbutt seems so difficult to work that it cannot be recommended.

Note by Government Botanist.

The timber in question was supplied to Mr. Frere for the purpose of his experiments on my recommendation, and his report is a valuable one, although I am sorry to say the results of his experiments do not bring out our timbers in too favourable a light. But honest opinion, and the results of systematic experiments, is what we require, as much harm has been done in time past by irresponsible over-praise of the properties of our timbers and value of them for specific purposes.

For those who desire further information I would invite consideration of my paper "Colonial Timber for Wine Casks" in the *Gazette* for June, 1894. See also papers by Mr. J. D. Lankester on timbers for wine-casks and vats in the *Australian Vigneron and Fruit-growers Journal* for July, 1890, and September, 1898.

Mr. G. S. Perrin has some "Notes on the Timber-trees of Victoria suitable for Wine-casks" in the Victorian *Journal of Viticulture*, p. 109. Mr. Alward Wyndham writes to the *Sydney Mail* of 15th September, 1894, speaking highly of native beech (of which, as will be observed, Mr. Frere speaks less favourably), and also has a note on rosewood, in regard to which I have some observations in my paper above quoted. Mr. Wyndham's letter is particularly valuable, and is quoted in extenso:—

AUSTRALIAN WOODS FOR WINE-CASKS.

To the Editor of the Sydney Mail.

Sir,

In Mr. Maiden's paper on this subject, given lately in the *Mail*, he has omitted one native wood—the beech—which is of high value for the purpose. Beech has been used at Bukkulla vineyard, near Inverell, for about thirty years for large casks and vats with the utmost satisfaction. With precaution in steaming the new casks, it does not impart a taste to wine, nor discolour white wine, and it is perfectly sound for holding. Its only fault is that it will not split into staves, and therefore does not suit for making hogsheads and smaller sizes. There is an abundant supply of it on the Richmond River near navigable water, and it can be got there cheaply—for instance, at Wardell. In this district (the Clarence) there is also abundance, but a good way back. To import European oak is to expend three times the cost for a less suitable wood. The silky oak splits excellently into staves. I have found it suit well for 5-gallon wine-kegs, although

from inclining to be porous the wine oozed out slightly at the ends of the staves the first time of using. Afterwards it takes up, and is perfectly tight. Boiling water put into the new kegs, after remaining in them for some days, was not discoloured at all; but it took a strong taste, which was not overcome till the scalding had been repeated half a dozen times. European oak discolours badly, and gives a stronger taste, necessitating at least as much trouble to get rid of it. I believe some salt added to the water quickens the effect. In my opinion the silky oak would answer for casks as large as hogsheads if the staves were made as thick as the stoutest oak rum hogsheads. To this there would be no objection, as they would still be lighter than the rum-casks. Also, the staves should be left long at the chime, and the heads should be made of beech. It is a beautifully easy-working wood. I have tried rosewood in the same way, but it is difficult to get the colour and taste out of it. Neither will it split, as a rule, I think. Otherwise it is a close, firm, light wood, beautiful to work.

I am, &c.,
ALWARD WYNDHAM.

I came across a valuable article by one of our pioneer vignerons, which is well worthy of reference now. It is called "Colonial Casks for Colonial Wines," and is to be found in the *Sydney Magazine of Science and Art* for July, 1857, page 28.—J. H. MAIDEN.

TREATMENT FOR SCOURS IN CALVES, PIGS, AND LAMBS.

WHEN scours begin in calves and pigs it is of little use to attempt to cure the disease until the cause of it is found and removed. Most frequently it is from indigestion caused by improper food, or food in an improper condition. We have known a severe case in a calf that was sucking its mother's milk; but we quickly found that she had been over-fed with grain after having been kept without it during the period that she had been dry. We have seen it caused by calves having their milk too sour when fed to them, and by its having been given too cold. A chill from a cold draught, or from lying in a wet bed may result in causing a severe attack in the calf, and sometimes when it was the cow that had suffered. While we never had a case among pigs or lambs while we bred them, we can understand or believe that the same causes might bring on the disease in them. Remove the cause and then try to give a remedy. If caused by a cold, give some warm and stimulating food or drink; a little spirits, ginger tea, or something of that kind in the milk will help. Then give charcoal to correct any acidity in the stomach, the fine or pulverised charcoal being the best form, with warm mashes, warm and dry beds, and even a warm blanket if they are sick enough to keep still. It is desirable when possible to remove any animals having this trouble to a clean place, and to not only cleanse, but disinfect any place they have been in before putting them back again, or using it for others. Spraying or washing with a strong solution of carbolic acid, or of corrosive sublimate, is not only desirable as a deodorizer, but as a destroyer of disease germs. Spraying is the better way, as the spray can be made to penetrate into cracks and to reach corners where washing would not touch. For lambs with scours give similar treatment to that given calves.—*Stock Breeder.*

Influence of Forests on Subterranean Waters.

THE following translation from the *Bulletin de la Société Centrale Forestière de Belgique* should be read and well considered by all those who have any interest in the country districts of New South Wales, and particularly those who are engaged in making livelihoods from the soil.

After years of observation I long ago came to the conclusion, and expressed my opinion officially whilst the Forest Department was under the control of the Agricultural Department, that it should be made imperative by legislation that a certain percentage of forest should be maintained on all areas sold or leased by the Crown, and that if a natural forest did not exist every encouragement should be given by the Department to assist in planting.

The destruction of trees and shrubs is going on merrily enough; but before many years have passed over I feel convinced that disastrous results will follow, particularly in the western country. Not only from a climatic point of view will this be the case, but the timber supply will become altogether inadequate even for domestic purposes. It is needless for me to write any further at present; but I most strongly urge that careful attention be given to this most important subject.—W. S. CAMPBELL.

THIS question has been recently discussed in a series of articles which have appeared in the *Review of Waters and Forests*. We find also in the January number of the *Review of Scientific Questions* (Scientific Society of Brussels), under the signature C. de Kirwan, a *résumé* of the work of M. Henry, with observations and objections from M. Broilliard.

We think it might be useful to reproduce this *résumé*, for besides being a subject of the highest importance, it is a question of the day for us, both on account of the desire of the Administration of Woods and Forests to find a solution, and the project of draining and making use of 10,000 hectares of marshy land (morass), in which a great number of our highland streams find their source.

Nobody disputes, at the present time, the influence which vegetation—and particularly forest vegetation on the mountain sides—has in checking the flowing streams and retaining the moisture in the soil, instead of rushing down unruly and devastating. This opinion has not been arrived at without a struggle. When, during the reign of Napoleon III, the economical policy of the Government tended, in opposition to public opinion, to the alienation of the State forests, some eminent engineers were brought forward to contest this fact; and further, to maintain that the forests, instead of regulating the water-courses and retarding the streams, greatly increased their violence, while at the same time they diminished the amount of the annual rainfall.

These astounding assertions did not pass without replies, and gave rise to ardent discussions. But what was of more importance, they led to the establishing of numerous careful meteorological observations, both in France and abroad, the details of which are too long to quote here. It suffices to state that as far as regards the enormously beneficial influence of forests on the water supply the fact was fully confirmed, while the assertions of the Engineer-in-Chief, Vallis, concerning forestry meteorology were proved by the actual facts to be false in every point.

But these meteorological observations brought to light several other unexpected results. Thus it was argued that in plains the level of subterranean water would be much lower on wooded than on open land, which opinion is elsewhere contested, as we shall see later on.

It has always been found that eucalyptus plantations dry the land (and by means of these the Trappist Fathers endeavoured, not unsuccessfully, to render the Roman swamps sanitary), and this is also in a smaller degree the case with resinous trees; but both these classes of trees have persistent leaves with more or less transpiration. Important observations, made on the vast plains in the interior of Russia, have proved that on a bare soil the subterranean water is reached at a depth of 3, 4, or 5 metres, while in the neighbouring forest of principally oak-trees the water-level is not reached at less than 10 or 15 metres.

On the other hand, it is a well-established fact that the rain is more abundant over heavy forest than on the plains, being attracted by the summits of the trees, as was found from various observations made in the forest of Haye, near Nancy.

The average of 30 years' observations, from 1867 to 1896, gives 150 millimetres (6 in.) more rain per annum on forest land than on open agricultural land, the observations having been made at the same altitude in both cases.

Similar observations in other places have given 1 inch for foliage trees and 2¼ inches for resinous trees. The same results have been obtained on the Steppes of Russia, where altitude and mountainous country have no influence.

With regard to the difference in the amount of rain received on forest land and open land, numerous experiments have clearly proved that the foliage and branches of trees intercept and absorb a formidable part of the rain-water, varying from 40 to 9 per cent. for leaf trees, and about half that for trees with persistent foliage.

It is also interesting to note that the evaporation from forest land is only about one-third of that from open land; and when the land is covered with moss, dead leaves, &c., only one-sixth.

A more difficult problem is to ascertain the ultimate disposal of the waters which reach the surface of the soil and are not evaporated. Part is retained by organic deposits on the top soil, another portion is absorbed by the roots of vegetation, and the balance sinks to form the subterranean water.

In experimenting to ascertain the first, no reliable results have been obtained, but this much can be said, that the quantity which is retained by the trees themselves is comparatively small.

At the Agronomical Forest Stations of Bavaria, organic matter dried at 100 degrees showed half carbon, and half water. "Thus," says M. Henry, "out of several millions of kilogrammes which descend, only about 3,000 are retained."

With regard to the proportion of water which goes to form subterranean springs, the matter is as yet reduced to mere probabilities, and still remains only a subject of conjecture.

If Ebermayer has been able to conclude from his experiments that the forests, while contributing less than the open soil, yet contribute more than pasture land and natural prairies, &c., it seems, however, from special experiments made in Russia by M. Ototsky, that forests contribute less than cultivated land to the feeding of subterranean waters, because the level of this (forest) water lies invariably lower than that under cultivated plains.

Finally, the result of thirty years meteorological experiments in various countries seems to show that level forest land, where there are no running streams, contributes less than cultivated land to the feeding of the subterranean reservoirs; but on slopes and mountain sides, particularly at high altitudes where rain and snow are plentiful, the forest land retains a much larger quantity than is required for the nourishment and exhalation of the trees, and this surplus goes to feed the subterranean waters.

The first of these conclusions is, however, strongly contested by an eminent French savant and conservator of forests, M. Brouillard, and the arguments he sets forth are so weighty that we must give a summary of them.

M. Brouillard states first that there are two questions of vital importance, to which as yet no satisfactory answers have been given.

Granted, as it is by everybody, that the forest retains and conserves the water which it receives, absorbs a portion, and evaporates another portion, the question is:—

(1.) In what proportion does this conserved water escape?

(2.) How do surrounding circumstances influence these two contrary actions?

Answers to these two important questions have not yet been forthcoming.

The eminent savant remarks, with truth, that since the cutting down of the forests on the steppes of Russia the rivers have become unnavigable, except during the rainy seasons.

He concludes, with reason, that notwithstanding M. Ototsky's opinion of the drying-up action of the forests, the Russians should not exterminate the trees and clear the forests on the meridional plains, as they undoubtedly preserve a large proportion of the small annual rainfall (which is from 8 to 16 inches).

The "Geographer" (Elisée Réclus) states that it is a very serious matter, particularly with regard to the Dnieper, which, in consequence of forest-clearing, has become quite irregular, the low tides being of longer duration and the inundations higher. This irregularity, caused by deforestation, exists not only in Russia, but likewise affects the principal rivers in France, taking the Loire as a notable instance.

It is just the same in America, where examples abound, especially in California.

On the plains of Minnesota, on the plateaux of the Andirondack, in the basins of the Mississippi, and the rivers Rouge and St. Croix. Here M. Brouillard is supported in his statements by the American authorities.

The same phenomenon also appears in the islands of Mauritius and Réunion. Wherever deforestation has taken place the river levels have fallen, and their flow has become irregular, causing serious damage. Even on islands in the middle of the ocean terrible droughts, before unknown, have taken place. On the other hand, on the island of St. Helena, a small plantation suffices to maintain a spring.

These are stubborn, general facts, against which small local observations can weigh but little, still we can discuss them. The difference between slopes where forests diminish the running water and plains where there are no streams is worth considering. How is it possible to explain that where there are no flowing streams the springs are less abundant than in regions where more water flows away and leaves less provision for the trees.

For one thing, the action of the trees is not uniform, and adapts itself in a large measure to circumstances.

Such trees as pines, piceas, oaks, &c., usually thriving in a damp soil, seem to grow very well on arid ; and specimens endowed with the greatest faculties of absorption by the roots—such as the Eucalyptus, most suitable for drying swampy land, show a marvellous resistance to the terrible droughts of Australia, its native land. Thus they all evaporate less water in dry climates than in humid.

The nature of the soil being more or less absorbent is also an important factor with regard to the retention of the water by the trees, or the forming of subterranean reservoirs.

It it quite evident that if a superficial layer of soil rests on a mass of stone blocks or flint pebbles, the water, pluvial or otherwise, will filter through very quickly, while a hard compact subsoil would retain it indefinitely.

In such places, above the subsoil, a watery sheet is rapidly formed, which remains stagnant if the surface is horizontal, or escapes if it is inclined.

On the other hand, on the terraced land of Karst, in Austria, on the flanks of Ventoux, in Provence, on the slopes of the Cevennes, on the plateaux of the Jura, composed principally of fissured rocks, the water received by the soil escapes immediately into the hollows and declivities, thus neutralising the action of the forest trees.* Another state is when the water is held, as it were, suspended between two strata of earth, sinking by gravitation or rising by evaporation, according to the action of vegetation ; but this condition can only exist in places where slow filtration takes place, produced by what M. Brouillard terms *méats capillaires*, or fine-grained soil, which absorbs and holds the water as if in earthenware.

It is probable that this is the case on the steppes of Russia, where M. Ototsky and his fellow-countrymen made their observations. Most probably these plains contain earthy matter at a great depth.

It is not possible for trees, even with the assistance of great capillarity of the soil, to lift water up to 10 or 15 métres.

It is rarely that the main root of even deep-growing trees like the oak penetrates more than 1 métre, and such trees thrive very well on a layer of vegetable soil of only 20 inches

* M. Brouillard made a curious observation in the forest of La Hardt, situated southwest of Mulhouse.

This forest contains 14,000 hectares, and rests on a heavy deposit of large alluvial boulders from the old Rhine River, which runs 14 métres below. A branch of the canal from the Rhone to the Rhine traverses this forest for a length of 20 kilométres, without locks.

A bank of the canal breaking, the whole of the forest was covered with water ; but three days afterwards all the water had disappeared in the subsoil, having filtrated between the boulders.

It is evident that in this case the influence of the composition of the subsoil was paramount, since, if the land had been bare, the same filtration would have taken place—probably quicker, as the top-surface soil of forests is generally spongy.—C. de Kirwan.

deep. The roots of the picea, and even the beech, run along the surface, and the pine also does not penetrate deeply. How is it possible for these roots to have any appreciable influence on layers of water 3 métres below ?

"We ourselves," judiciously observes M. Brouillard, "foresters who have operated, not in Russia but in France, have rather too often got our feet wet, and our boots covered with black mud in the height of summer in the forests on the plains, to fear seriously the drying up of the soil by the forests. We also prefer to wait till a better hydraulic system has been inaugurated for the rivers of Russia, which do not arise in the mountains, or the rivers of Minnesota, born in the flat regions of the Thousand Lakes, before cutting down the forests on our own plains in order to preserve the water."

And with these wise conclusions we can thoroughly agree.

Composted Manure.

In connection with the subject of properly preparing stable-manure before applying it, the writer, in the latter part of last autumn, set about the arrangement of a compost heap. Equal quantities of manure from horses fed on oaten chaff, maize, green oats and maize-stalks were intimately mixed with black mould scraped up in the bush, and the heap was laid upon and covered with the coarser particles of ferns and leaves used for bedding. In August three large shovelfuls of compost, which cut like cheese, and was of a very dark colour, were lightly forked around each young orange and summer fruit-tree. Most of the trees had, last summer, been affected by insect pests, and had shown signs of distress. By the beginning of October they had commenced to grow most luxuriantly, and had cast aside all signs of debility. It is not argued that the rampant growth now going on is always the best thing possible for young citrus trees; but in cases, such as the one in point, when the tree appears to have come to a standstill, and instead of producing enough wood before maturity to make a good substantial tree that is able to shade its own stem, and bear the weight of a crop, is expending its energy in the putting forth of thousands of useless blooms, healthy growth is essential. To safeguard the tree from the effects of a possible dry season, well-rotted leaves should be applied as a thick mulch as soon after rain as possible this month.

Crops of oats manured with compost, prepared in the same way, did very well; but one crop manured with compost containing a little bone-dust (½ cwt. to the ton) grew like wild-fire, and attained a height of 5 ft. 6 in. before a crop sown in similar land, with fresh bone-dust only, had reached 18 inches in height. Another crop which had received nothing beyond good cultivation, on the same class of land, looked in comparison with the other plots like an upturned, worn-out blacking brush.

Fruit-growing under Irrigation.

W. J. ALLEN.

The question of raising suitable fruits for drying purposes has been greatly neglected in this Colony, and it is matter for comment that, in these days of so-called progress, New South Wales, with all her natural advantages of soil and climate, should have to depend almost entirely on her imports; in fact, not only have we some of the best soil and climate for raising the different kinds of fruits in sufficient quantities to supply our local markets, but also to open up a large and paying export trade.

To undertake this work on such a scale it would be necessary that some body representing a fair capital, should secure some good, rich, well-drained land, so situated that it could be economically watered from a never-failing source.

I have given this subject considerable thought during the past two years, and, from all I can gather, the only safe place where an irrigation settlement, sufficiently large to go into the fruit-drying industry on a large scale, might be started, would be on the river Murray, as, during the past dry year the Lachlan was practically dry in many places, and the Murrumbidgee was also very low. The only places on the latter where anything like a supply could be obtained during dry years, would be somewhere close to its junction with the Murray.

There, then, arises the question of good light land, suitable for all kinds of fruit-culture. If this cannot be secured close to the river, and at a reasonable height above summer-level, the pumping would prove very expensive. This brings us to three very important points, which must be kept in mind in undertaking an irrigation scheme:—Firstly, good, deep rich-red or chocolate loam, close to the river, and at not too great a height above summer level, but so high that the highest floods would never submerge any portions of it; secondly, the place chosen must be on the bank of a never-failing supply of good water; and, thirdly, where fuel for pumping purposes would not be too expensive; that is, where wood or coal could be obtained in quantities at a reasonable cost, provided gasoline-engines were not used. In America, of late years, the latter are coming into favour more and more every day. They are easily managed, and a good smart man—not necessarily an expert engineer—can run them.

Many critics may say, "What about Mildura and other irrigation colonies of Australia? Surely the lessons they have taught the general public are enough to keep others from going in for irrigation!" To these I would answer, "Yes, it has." Mildura and other places, however, have taught us what mistakes to avoid, and have also shown us

what excellent results can be obtained by those who avoided those mistakes, and were fortunate in securing the best soils. These latter, who comprise nearly all who have remained in Mildura, are obtaining better returns than ever they had expected. Some of the finest sultanas, pudding-raisins, apricots, and peaches on the market are those grown under irrigation.

By some it is contended that fruit grown under irrigation dries away more during the drying process than fruits grown where irrigation is not practised. Personally, I do not think there is very much difference. I have grown fruits under irrigation for nineteen years, and have also grown them in climates where they will, with thorough cultivation, do well with the natural rainfall; and my experience is, that unless one is exceptionally favoured as to locality and soil, the irrigated orchard will return far and away the best crops, both as to quality and quantity.

It is well known that some varieties of peaches and apricots dry away more than others, so that, in order to effect a proper comparison, fruits of a like variety, but grown under the different conditions, must be chosen. As far as I am concerned, I should never for one moment hesitate to give fruit-growing under irrigation the preference.

In this connection I would quote from a paper on "Deciduous Fruit-growing in California," read by Mr. J. H. Read, of Riverside, at a meeting of the Southern California Pomological Society:—

"It is claimed that there is a larger percentage of shrinkage in drying irrigated fruits, and I must confess this was my own supposition till my experience convinced me otherwise. You, perhaps, will pardon reference to this experience, as it seems to the point. Our first apricot-orchard was interplanted among young lemons. The lemons were to make the permanent orchard, and all treatment was especially with reference to them. We had plenty of water, and applied it generously throughout the year, except when winter rains made it unnecessary. The season after the 'cots had been planted two years we took from 25 to 75 lb. of extra-fine fruit per tree. The next season—third year—they returned from 100 to 300 lb. per tree. The present year—the fourth—they promise to double these amounts. So much for quantity. The first season we kept careful account of results in drying, as we were drying for other parties apricots grown without irrigation. Very much to my surprise we found that, of the unirrigated, it had taken $5\frac{6}{10}$ lb. of green fruit to make 1 of dried, while of our irrigated apricots it had taken but $4\frac{2}{10}$. A little thought should have relieved us of our surprise. The water taken up by the roots does not pass direct to the fruit, but goes to the leaves, where its food-contents are fitted for the fruit and wood growth, and the surplus of water goes into the air.

In the rapid growth of the young tree an early fruitage is an important advantage. Our irrigated trees had produced more fruit at three and a half years from planting than trees in the neighbourhood without irrigation had in twice the time."

In the year 1880, there were shipped from Riverside, California, only a few thousand cases of citrus fruits; but, in the year 1898, there were shipped from that one irrigation settlement alone 1,350,000 cases,

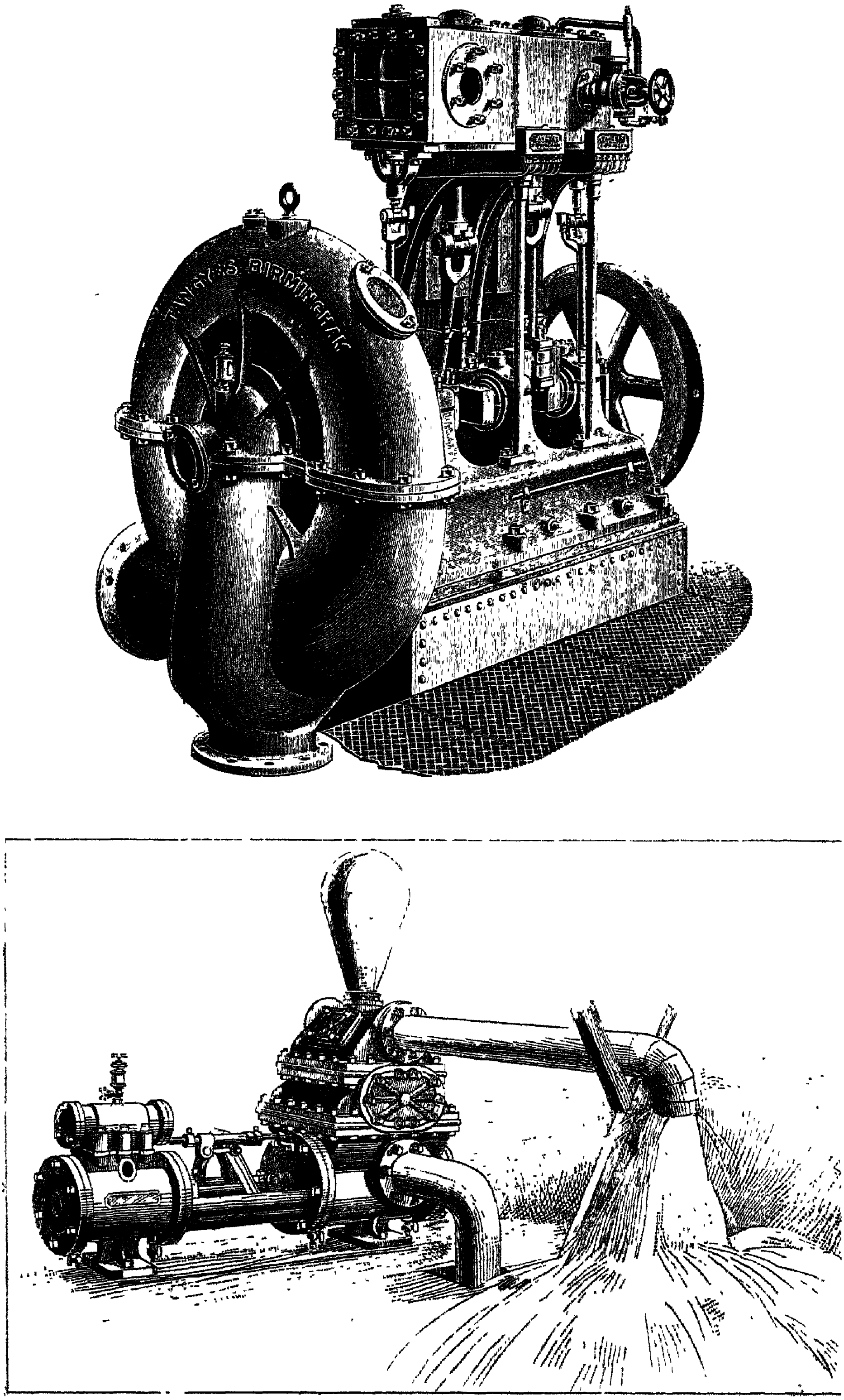
each of which cases holds about 65 ℔. fruit. The 2-cubic foot case is used exclusively there. This fruit would average about 6s. per case. It can be seen, therefore, that this one industry is a big thing; but large areas of fruits suitable for drying are also under cultivation, and thousands of tons of raisins, apricots, and peaches are also cured annually.

I spent ten years growing fruit under irrigation in Riverside, and during that time there were always those who predicted that our market would become glutted, and fruit unsaleable. In spite of these croakers, however, year after year saw large areas of land being planted, and each year they have reached out and opened up new markets, as well as combining—the fruit-growers forming trusts so as to place their products on the markets in the best possible manner, and to sustain even and remunerative prices. The consequence is that to-day the growers are obtaining as high prices for goods as they were getting when first I went there nineteen years ago. It is impossible to grow anything there without irrigation, so that, of necessity, every pound of fruit shipped from that settlement is grown under irrigation.

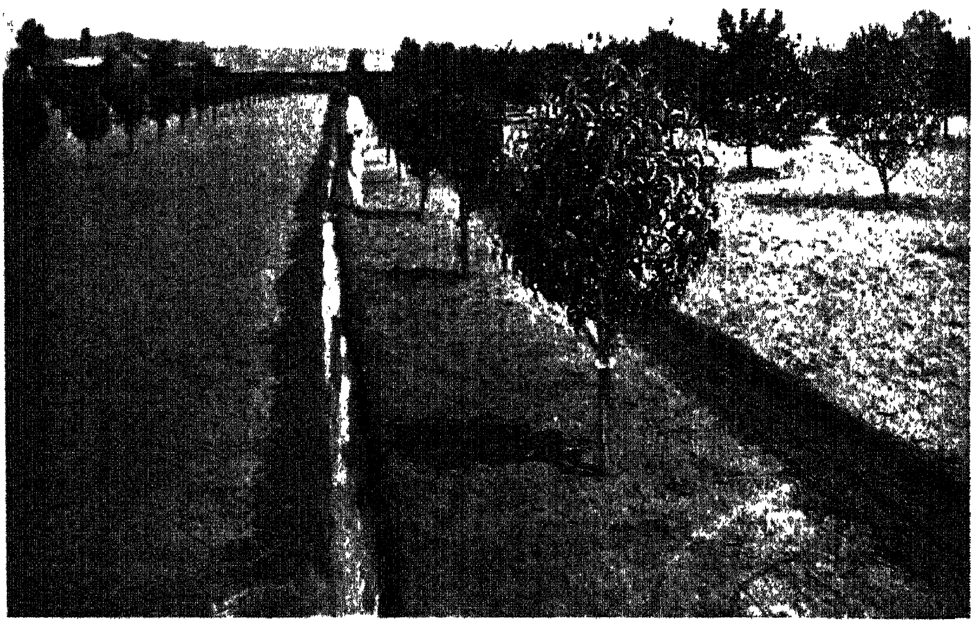
I refer to this in order to substantiate my contention, which is, that we, on this side of the world, are very much behind the times in this particular industry, and that there is still a wide field of operation for the man who wishes to put capital and brains into fruit-growing in our warmer climates, where, of necessity, irrigation must be practised, and where we can grow the very best fruits for drying, as well as citrus fruits suitable for export.

The past few years of severe drought have taught us valuable lessons. They have demonstrated where a permanent supply of water is available for irrigation purposes, and this in itself is a very important lesson, as, should the supply of water fail when once large orchards had been planted and grown under irrigation, it would mean ruination to those who were dependent on the supply. If water can be laid on the land by gravitation from a never-failing source of supply, it is the best method to adopt; but in Australia, I fear, this system would not work, as the rivers have very little fall, and, as far as I have seen, the lands best adapted for fruit-growing usually lie about 40 feet above the summer-level of the river. To raise the water this high, centrifugal pumps are used. These have done good work; but the great question is the power to run them. Wood has been found very cheap for the first few years, but as the supply of timber in close proximity to the pumping stations becomes exhausted the cost of fuel is greatly increased owing to the price of cartage for long distances being added thereto. This, naturally, tends to increase the water-rate per acre per annum; therefore, before any large area of land is put under water, it would be well to go closely into the cost of the different fuels, and to be governed by the conclusion arrived at as to the kind of machinery to be adopted.

As I stated before, in America the Gasoline-engines are coming into general favour, and are giving entire satisfaction both in ease of manipulation and cheapness of fuel; and are in successful operation with as high as 100-h.p. engines. The following is a description of a



TYPES OF PUMPING ENGINES FOR IRRIGATION PURPOSES.



IRRIGATING AN ORCHARD.
Ordinary furrows for young trees.

54-h.p. Fairbanks and Morse Gasoline-engine, which I have taken from the *Pacific Rural Press* :—"The engine is of the single cylinder-type, and weighs nearly 10 tons. The fly-wheels are each 6 feet in diameter, and together weigh 3 tons. One of the fly-wheels serves also as the belt pully, carrying the large 14-inch rubber belt which is connected to the pump. No babbit metal is used in the construction of this engine, the bearings throughout being phosphor-bronze."

"*Fuel.*—The fuel used is 'distillate,' a low-grade gasoline, of about 52° specific gravity. It costs 10 cents. (5d.) per gallon, and the engine consumes about 48 gallons in ten hours run. 'Distillate' is much cheaper than the other forms of gasoline, such as 74°, and deodorized stove gasoline. The economy is apparently the same, and no complaint has been of fouling or gumming either the valves, piston rings, or electrodes. The engine starts 'cold' on 'distillate' without the use of any heaters, vaporizes, or carburetors."

"*Capacity.*—The irrigating water is pumped from Putah Creek by a 12-inch horizontal centrifugal pump, placed 10 feet above the surface of the water, which is drawn through a 15-inch suction pipe. The water is discharged at an elevation of 15 feet above the pump through a 15-inch discharge pipe, the total elevation of the water being 25 feet. The capacity of the plant is approximately 4,500 gallons per minute."

"The plant embodies a number of up-to-date ideas. For instance, a small dynamo is used for generating the current for the electric igniter on the engine. A small auxiliary centrifugal pump is used for cooling the cylinder, utilising for this purpose a small portion of the water discharged by the large centrifugal pump."

"The system of priming the large centrifugal pump is also novel. Instead of the slow and tedious method of priming by hand with a small air-pump, water from the ditch is pumped by the small circulating pump, and stored in large tanks located on the tank above the large pump. Then, to prime, a valve is opened, and water from the tanks primes the large pump in three minutes."

Laying out Land for Irrigation.

In laying out land for irrigation the main channel should be situated on the highest point of the area to be watered, so that the water can be supplied to the largest area of land with the least possible amount of channeling, and all channels, whether main or lateral, should be concreted and cemented so as to avoid loss of water through seepage. If channels are not concreted and cemented there is always a large percentage of the water raised lost through seepage, which naturally increases the annual cost of pumping, and, in time, ruins the lands adjacent to the channels.

Means of applying Water.

Two systems of applying water to the land are in vogue, one called the basin and the other the furrow system. In the former I do not believe. No doubt it has its advantages in cases where the water is

available for a few hours only at a time—in this case the basin system is the only feasible manner of accomplishing good results. But, on the other hand, where water is available for a reasonable length of time the furrow system is by far the best way of applying water to the land where trees and vines are growing. Small streams may be turned into each furrow, allowing just sufficient water to keep them wet from end to end, and never allow the water to flood the land. The water should be allowed to run in the furrows about twenty-four hours, but care must be exercised to prevent waste through allowing too great a head in any one furrow, which not only wastes the water, but carries off at each irrigation a portion of the surface soil. In California we allowed the water to run in each furrow from twenty-four to forty-eight hours, and the orchards were watered from three to five times in the year, according to the variety of fruit grown. Thorough cultivation is just as essential as thorough irrigation, and immediately the land is dry enough after a watering it should be worked up to a fine tilth.

When soils can be kept moist by cultivation it is all that Nature can ask to permit her to do her best work. When cultivation cannot do the work, irrigation must step in and supply the want, and whenever the orchardist provides himself with facilities for furnishing water when needed, he places himself beyond the influence of the vicissitudes of dry seasons.

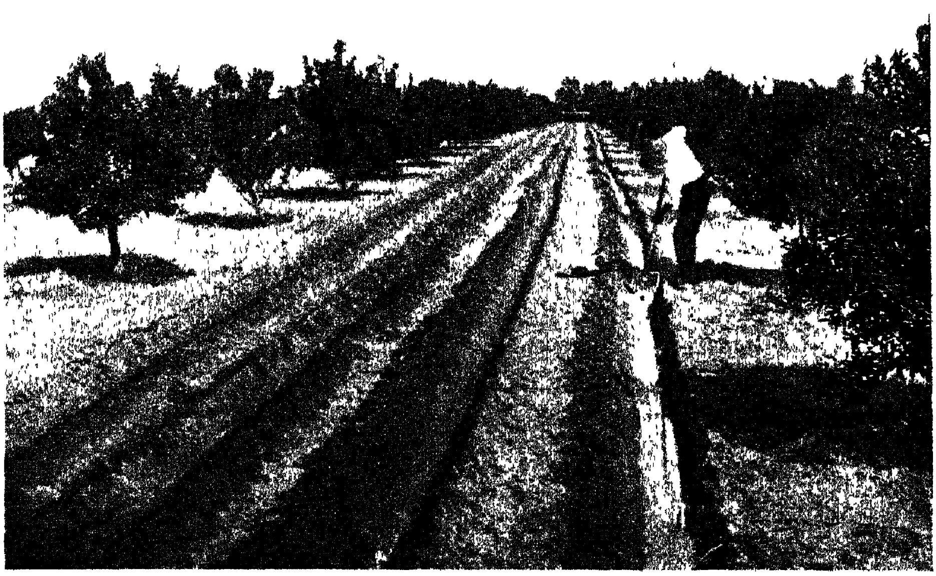
To try to do by irrigation what ought to be done by cultivation is a mistake that is being made by many where water is abundant. Sodden, water-soaked soil will produce sodden water-soaked fruit, something not desired nor desirable to driers, canners, shippers, or consumers.

To keep the soil simply moist at all times so that the soluble material required by the tree is constantly going into solution, water enough to keep the roots fresh and growing, and to provide a medium to circulate freely in all the tissues of the tree for the conveyance of organised material to every part, is the ideal condition. Keep it so, if possible, by cultivation. If not, then by irrigation, just when it is needed to keep up this condition, be it spring, summer, or winter.

In the arid regions irrigation is, of course, a necessity, but, even then, care must be had not to over-irrigate, and the more the soil is irrigated the more cultivation is required.

The best soil for fruit-growing is a good, deep, sandy loam, with a natural drainage. Such soil has produced heavy and regular crops of the very finest quality of fruits, and owing to its warm nature many varieties of fruits set better than on the heavier soil. The raisin grape produces a very much larger crop, and the quality of the dried product is usually of the highest grade.

In Australia we have a great variety of soils, but many of these, while suitable for growing cereals under irrigation would never answer for growing fruit under irrigation. Generally speaking mallee soils are not suitable for growing fruit-trees, but the olive if once started on this soil will thrive and produce heavy crops, while citrus and most deciduous trees and vines will invariably die after a few years. On the other hand, this salty land is admirably adapted



IRRIGATING AN ORCHARD.—Furrows for bearing trees.

for lucerne growing, and I have taken crop after crop in succession of the very best lucerne hay from such soil by giving it a thorough flooding every month, and this for a number of years.

Neither is the heavy box country suitable for fruit-growing in most cases, as it is next to impossible for water to penetrate this class of soil; and it is often found that water will lie in the furrows for days without disappearing, therefore such land is to be avoided for growing anything under irrigation.

The deep light soils found in the blue-bush country will generally grow fair fruits, but the clayey and heavier blue-bush country is practically valueless for anything but lucerne or maize-growing, and then only when frequently irrigated.

It will, therefore, be seen that in selecting soil for growing fruit under irrigation, that if best results are to be achieved the grower must choose good, deep, rich, red or chocolate loam, with, as I before said, a natural drainage.

After the selection of suitable soil, the next most important step is to choose the varieties of fruits which will prove most profitable under irrigation in a hot, dry, climate, and such as will either dry, can, or keep well, as of necessity fruit-growing under irrigation would have to be started inland, and some distance perhaps from any of our large centres and somewhat remote from railway communication. Therefore, as river carriage cannot be always depended upon for marketing fresh fruits daily during the season, only such deciduous trees should be planted as will produce best quality of drying fruits, as, for instance, apricots, peaches, figs, nectarines, &c. Olives for oil and pickling; almonds for nuts, Gordo Blanco or muscat of Alexandria; grapes for raisins, Sultanas and Thompson's seedless grapes for seedless raisins; Zante currants for currants. Suitable varieties of apricots and peaches should also be grown for pulping and canning; but apricot pulp is always in greater demand than peach pulp. The same may be said of the dried product as well.

Oranges and lemons, when grown in the dry climate, keep well, and are suitable for export. Nothing but the very best varieties should be grown, and these must receive intelligent attention.

The dried fruit production of the colonies has not yet begun. With the artificial use of water for the best of our barren country and improved methods of cultivation and fertilisation, I am sure that a great future awaits those who care to take up this industry.

In starting an orchard or vineyard a certain amount of capital is required. Therefore an irrigation settlement is a good place for the man with capital, as he can at once clear and plant his holding whether it be 10 acres or 50 acres. To do this he must employ labour, not only for clearing and planting, but for care of the place until it comes into bearing, which means that capital must be employed until the trees come into bearing.

Irrigation necessarily prevents a monopoly of the soil to any large extent, compelling small holdings as being more economical. Owing to the fact that machinery on any very extensive scale cannot be used, labour will always be in demand, hence on an irrigation settlement,

where fruit-growing is the principal occupation, we can never expect the cultivators of our lands to degenerate into mere machines, as every operation in connection with the soil and its productions requires the exercise of skill and judgment, and will necessarily call for a high degree of intelligence in the owners and occupiers of the arid regions of our country, which are to be irrigated. On such a settlement there will be a dense population, and past experience justifies us in saying that our now arid lands, which are susceptible of irrigation, will be the seat of a higher cultivation than any which has hitherto existed in this country.

Weevils in Grain.

On several occasions advice has been given as to what is considered the best means of protecting grain, especially maize, from the ravages of these pests. A carefully-swept shed and the scalding of second-hand bags will do a great deal to prevent weevils, but in some of the best maize-growing districts the insects appear as if by magic, and the grain is infested with them before you know where you are. Experiments have been tried to test the efficacy of subjecting market maize to a high temperature in great iron cylinders; but it is feared the product will have to attain a very exalted commercial status before such a method can commend itself to the ordinary farmer.

The only treatment that up to date can be confidently recommended as at once cheap and effective is the use of bisulphide of carbon. One pound of the chemical, costing 1s. per lb., will destroy all the insect life in 100 bushels of maize in a bin, or will be effective in 1,000 cubic feet of space. It forms a dense gas, heavier than the atmosphere, and consequently it not only permeates the grain on top of which it is placed (in saturated cotton-wool or waste), but finds its way into the crannies and crevices in which the little bounders hide and breed. The offensive odour of it will have quite passed away by the time the grain is marketed. When a moderate quantity of seed is required for next season's sowing, the best thing to keep it in is an iron tank, or even a tin-lined packing case, if it can be made air-tight. Put on top of the grain a piece of cotton wool, saturated with carbon bisulphide, and then the seed will be as safe as a castle. Some river farmers have tried the dodge of putting on top of the grain about an inch of candle and sealing up the tank while it is still burning. By the time the candle goes out it will have exhausted all the oxygen in the receptacle, and if no more air can get in the weevils will perish. If it is necessary to remove any grain from the tank at any time, provision can easily be made to withdraw it from a tap or bunghole in the bottom, so as to minimise the ingress of air. In using bisulphide of carbon, care should be taken not to let the fumes come in contact with a light.

Formulæ for Preparing Fertilisers for different Crops.

(Concluded.)

F. B. GUTHRIE.

No. 16.

For Cabbages, Cauliflowers, &c.

THESE plants make heavy demands upon the plant-food in the soil, and require very liberal manuring. The increased production obtained by manuring is, however, of considerably greater money-value than the cost of manuring here recommended, which may at first sight appear rather high.

A.

	Quantities per half-ton.	Cost. £ s. d.
Bone-dust	800 lb.	1 16 0
Sulphate of potash	320 lb.	2 0 0
	1,120 lb.	£3 16 0

Apply the above at the rate of 4 cwt. per acre when sowing or planting-out.

This will give a dressing of—

11 lb. nitrogen ...
64 lb. phosphoric acid } per acre.
64 lb. potash ...

The nitrogen and phosphoric acid in the above are in slowly available form, and should be supplemented by a top-dressing, just before the heads begin to form, of—

B.

1½ cwt. sulphate of ammonia
1 cwt. superphosphate ... } per acre.
½ cwt. sulphate of potash ...

This dressing will cost 22s. 6d. per acre, and there will have been given a total dressing of—

41 lb. nitrogen ...
81 lb. phosphoric acid } per acre—
89 lb. potash... ...

at a total cost of £2 12s. 6d. per acre.

No. 17.

For Onions.

	Quantities per half-ton.	Cost. £ s. d.
Dried blood or nipho	400 lb.	1 0 0
Bone-dust	300 lb.	0 13 6
Superphosphate	150 lb.	0 6 6
Sulphate of potash	270 lb.	1 16 0
	1,120 lb.	£4 16 6

This fertiliser contains—

$5\frac{1}{4}$	per cent.	nitrogen.
$7\frac{1}{2}$	,,	phosphoric acid.
12	,,	potash.

It should be applied before planting, or when planting at the rate of 8 cwt. per acre.

After the crops have well started, a top-dressing of sulphate of ammonia mixed with dry loam (about $\frac{3}{4}$ cwt. sulphate of ammonia per acre) should be given. It is advisable not to give the whole dressing at once, but in small quantities and at intervals.

This will provide for a total dressing to the crop of—

57 lb. nitrogen ...
60 lb. phosphoric acid } per acre—
96 lb. potash ... ...

the nitrogen and phosphate being in both slow-acting and readily-available forms. The total cost will be £4 3s. per acre.

No. 18.

For Maize.

	Quantities per half-ton.	Price. £	s.	d.
Dried blood	320 lb.	0	16	0
Bone-dust	250 lb.	0	11	6
Superphosphate	400 lb.	0	17	0
Sulphate potash	150 lb.	1	0	0
	10 cwt.	£3	4	6

This mixture contains—

Nitrogen ...	=	$4\frac{1}{2}$ per cent.
Phosphoric acid	=	10 ,,
Potash... ...	=	$7\frac{1}{2}$,,

Applied at the rate of 5 cwt. per acre this will give—

Nitrogen ... $22\frac{1}{2}$ lb.
Phosphoric acid 50 lb. } per acre—
Potash... ... $37\frac{1}{2}$ lb.

at cost of £1 12s. per acre.

No. 19.

For Tobacco.

	Quantities per half-ton.	Price. £	s.	d.
Sulphate of ammonia	420 lb.	1	18	0
Superphosphate	400 lb.	0	17	0
Sulphate of potash...	300 lb.	2	0	6
	1,120 lb.	£4	15	6

This gives—

Nitrogen ...	=	$8\frac{1}{2}$ per cent.
Phosphoric acid	=	7 ,,
Potash... ...	=	15 ,,

Apply at rate of 10 cwt. per acre, supplying—

85 lb. nitrogen ...
70 lb. phosphoric acid } per acre—
150 lb. potash... ...

at a cost of £4 15s. 6d. per acre.

Local Fertilisers.

The formulæ here given have been prepared especially with the view of utilising to the best advantage the manures most readily and cheaply obtainable in the Colony.

These consist, on the one hand, of carcase manures, such as boiling-down refuse and similar products, bone-meal, dried blood, desiccated soup, &c.; and, on the other, of fertilisers having as their basis substances such as the bone-char of the Colonial Sugar Refining Company, rendered more or less soluble by treatment with sulphuric acid.

Imported fertilisers of this latter class are usually prepared from mineral phosphates similarly treated with acid.

The complete fertilisers are prepared from these phosphatic materials by mixing them with sulphate of ammonia or nitrate of soda and potash-salts.

The sulphate of ammonia which supplies the nitrogen in the locally-manufactured manures of this class is obtained locally from the ammoniacal liquor of the gas-works and as a by-product in the process of sugar-refining.

In the imported fertilisers nitrate of soda is usually substituted for sulphate of ammonia.

There is practically little to choose as far as efficiency is concerned between these two forms of readily available nitrogen, and their choice will depend upon the cost. The local price of nitrate of soda is £15 per ton, whilst sulphate of ammonia, being prepared locally from by-products, can be purchased at £9 per ton.

Since nitrate of soda contains about 18 per cent. nitrogen, and sulphate of ammonia over 20 per cent., the cost, locally, of nitrogen in the form of sulphate of ammonia is about one-half that of the nitrogen in nitrate of soda; the nitrogen in sulphate of ammonia costing 4¾d. per pound, against about 9d. per pound as nitrate of soda.

The potash-salts, both in the locally-prepared and the imported fertilisers, are obtained from the great saline deposits at Stassfurth, in Saxony, which supply the world with kainit, sulphate and chloride of potash, &c.

Recently there have been put on the market, and used for preparing fertilisers, potash-salts obtained as a by-product in a local industry under the name of Australian Potash.

Here, again, the availability of the different forms of potash is much the same, and it becomes a question of cost. Potash in the form of sulphate is both the most economic form and the one most universally applicable, and it has been used exclusively in the formulæ.

In the form of chloride it is found not to be so beneficial to all crops, potatoes and tobacco being particularly crops which are not greatly benefited by the application of chlorides. Kainit being a form of potash which contains chlorides, should be avoided in these particular instances.

Potash-salts may also be beneficially applied in the form of wood-ashes (unleached). The potash in wood-ashes is in the form of carbonate for the most part, and is equally available for plant-food as

the sulphate or chloride. If wood-ashes are substituted for sulphate of potash in any of the formulæ given, it must be remembered that they contain free lime, and must consequently not be mixed with fertilisers containing ammonium salts; also the ashes from our local trees contain, in the average, not more than 3 or 4 per cent. potash, and it will require 13 to 14 cwt. wood-ashes to provide the same amount of potash as is contained in 1 cwt. sulphate of potash.

Comparison of these Formulæ with those at present on the Market.

The formulæ here given are so devised as to provide the fertilising ingredients in the quantities per acre which recent experiment has shown to be most suitable to the different crops, having regard also to the proper proportion of soluble and slowly-available plant-food and of organic and ammoniacal nitrogen. They are calculated to average land, and may be modified to suit land particularly rich or particularly poor in any individual ingredient. In cases where farm-yard manure is used, the fertilisers here recommended may be added in smaller quantities, provided the manuring has been fairly liberal.

The quantities have been calculated to the half-ton in all cases, so that only a very simple calculation is required to provide any required amount. In such small quantities it will probably be found more economical to purchase the ingredients and to mix them. Any of the manure agents will, of course, supply the formulæ ready mixed.

Comparing these formulæ generally with the composition of the mixed fertilisers, both locally-made and imported on the market, it will be found that the difference is chiefly in the larger proportion of potash they contain and the smaller proportion of phosphates. This is notably the case with the manures sold until recently by the Colonial Sugar Company, and still on the market.

As long as these fertilisers have been on the market they have undergone no alteration in composition, and the new ones that have been added contain about the same proportion of the different ingredients.

During the last ten years, however, an enormous number of careful experiments have been conducted, more especially in the United States and Germany, and our views as to the proper manuring for different crops have undergone considerable modification. The formulæ published in this and recent issues of the *Gazette* are more in accordance with our present knowledge of the subject, and will be found to represent the now generally-accepted views as to the proper proportions and quantities of the fertilising ingredients.

Further experience will, no doubt, suggest modifications in some cases, and I look forward very shortly to the Department of Agriculture being able to institute some exact experiments which will have the particular advantage of being carried out under the conditions that prevail locally.

The manuring here recommended has, however, formed the basis of the treatment recommended in individual cases by the Department for several years past, and have always given successful results locally.

Substitution of one ingredient for another.

Attention has been given to supplying the requirements of the crops, not only as to the quantities of the fertilising ingredient, but also as to their condition. It is found that some crops require their plant-food in as readily-available and concentrated a form as possible, whereas with others better results are obtained by supplying them with plant-food which becomes slowly available. In the matter of the nitrogenous manuring some crops derive more benefit from manuring with organic nitrogen, such as bones, meat, &c., whilst others give better results when supplied with their nitrogen in the form of ammonium salts or nitrates. Some discretion must, therefore, be used in substituting one ingredient for another. And, speaking generally, only manures of the same kind should be substituted for each other.

In a formula providing nitrogen, for example, in the form of dried blood, if it is desired to substitute another form of nitrogenous manure, one should be selected containing its nitrogen in the same condition, such as bone-dust, or a similar product. It is not generally advisable to replace it by sulphate of ammonia or nitrate of soda.

The following notes, which are based on the 1899 list of fertilisers on the market issued by the Department of Agriculture, will be of assistance in making such substitution. It must also be remembered that the substitution of one ingredient for another in a given formula affects the proportion of the other ingredients, and the whole formula must be re-calculated.

Thus, suppose in No. 1 Formula it is desired to use kainit instead of sulphate of potash. Kainit only contains about 13 per cent. potash, so that 480 lb. kainit will be required to replace 120 lb. sulphate of potash. But the total will be no longer 1,120 lb, but 1,480 lb., and this mixture applied at the rate of 3½ cwt. per acre would give only

8 lb. Nitrogen.
35 lb. Phosphoric Acid.
21 lb. Potash.

In re-calculating such a mixture the point to be kept in view is not so much the percentage composition of the mixture as the amount of fertilising ingredients provided per acre.

Fertilisers containing similar ingredients, and which are interchangeable in the formulæ, are grouped together and their price and average composition added:—

A.—NITROGENOUS MANURES.

1. Animal Products containing Organic Nitrogen and Insoluble Phosphoric Acid.

Bone-dust.—A good sample of genuine bone-meal should contain from 3½ to 4 per cent. nitrogen, and about 20 per cent. phosphoric acid. Where bone-dust has been used in the formulæ, a product of about this composition has been assumed. Bone-dust varies, however, very considerably, as all sorts of meat-refuse is sold locally under this name, some of which contains very little bone. Its cost is about £4 10s. to £5 per ton.

Boiling-down refuse.—Gee's fertiliser, &c., on the average about 7 per cent. nitrogen and 9 to 10 per cent. phosphoric acid. This is the composition assumed in the formulæ. In the local trade, however, a great deal of boiling-down refuse is sold as bone-dust, and it is not easy to draw a very sharp line. The cost is usually about £5 per ton.

The following contain organic nitrogen only :—

Dried blood contains 12 to 13 per cent. nitrogen, and costs about £6 per ton.

Desiccated soup, nipho, nitrogenite, &c., are products locally prepared from the boiling-down products, and contain about the same proportion of nitrogen as dried blood. The price is about the same.

The nitrogen in the above products is all derived from the same source, and is more or less slowly available as plant-food. These products may all be substituted one for the other, as far as their nitrogen is concerned. Due regard, of course, must be paid to the different amounts of nitrogen they contain.

2. Salts of Ammonia and Nitrates containing Nitrogen in a very soluble and quick-acting form.

Sulphate of ammonia contains a little over 20 per cent. nitrogen, and costs about £9 per ton. This is the cheapest form in which this ingredient can be obtained in the local market, each pound of nitrogen costing about 4¾d. In the form of dried blood the nitrogen costs almost exactly 5d. per pound.

Nitrate of soda contains about 16 per cent. nitrogen, and is sold locally at £15 12s. per ton—a price that is quite prohibitive.

Nitrate of potash contains 13½ per cent. nitrogen, and, in addition, 44½ per cent. potash. It is sold at £20 per ton. I have not made use of it in any of the formulæ, as I have no experience of its use as a fertiliser. If used, it may be substituted for sulphate of potash and sulphate of ammonia.

B.—PHOSPHATIC MANURES.

1. Phosphates derived from Bone and Mineral Phosphates not treated with Acid.

The phosphoric acid in both these classes of fertiliser is in the same form, tribasic phosphoric acid. They may be substituted one for the other, but not with the next class (2) of phosphates.

Bone-meal and bone-dust in all forms, green, dried, steamed, &c., except treated with acid (dissolved). Their composition and price is already given under nitrogenous fertilisers.

Mineral phosphates.—A few of these are imported and used for the manufacture of superphosphate. I am not acquainted with any sold as untreated phosphates.

Phosphatic guanos.—Several of these are on the market; their composition is very variable, and their price also. They have not been made use of in the formulæ.

2. Superphosphates prepared by treating the above substances—Bone-dust, Bone-char, Mineral Phosphates, Phosphatic Guanos, &c.—with Acid.

The phosphoric acid is in a soluble and readily-available form.

Examples of these are the Sugar Company's No. 1, Lawe's superphosphate, Albert's concentrated superphosphate, Ohlendorff's dissolved Peruvian guano, Odam's superphosphate, &c. These may all be substituted for each other in the proper proportions.

The "superphosphate" used in compiling the formulæ is Sugar Company's No. 1, containing about 17 per cent. water-soluble phosphoric acid.

The high price of the imported superphosphates put them out of court, with the exception of Lawe's superphosphate. The latter contains 14½ phosphoric acid soluble in water.

The phosphoric acid in No. 1 is a trifle cheaper than in Lawe's, costing 2¾d. per pound. In Lawe's phosphate it costs a trifle under 3d. per pound.

3. Basic Slag—Thomas Phosphate.

If this is used instead of superphosphate in the preparation of the formulæ, I would recommend its use separately, as in formula No. 4, applying the nitrogen and potash as a top-dressing later on. In the formula cited, which is for wheat, a large proportion of phosphoric acid is required; with other crops, the amount of superphosphate in the top-dressing will be correspondingly reduced.

C.—POTASH MANURES.

These manures all contain their potash in a very soluble and readily-available form, and all fall into the same class, and may be substituted for each other, with proper regard to the amount of potash they contain.

Sulphate of potash is the most universally applicable; it contains about 52 per cent. potash, and costs £13 10s. per ton.

Kainit contains about 12½ to 13 per cent. potash, and costs £4 per ton. It contains, in addition, chlorides, as well as magnesium salts, &c.

Potassium chloride (muriate of potash) contains 57 per cent. potash, and costs £13 15s. per ton.

Nitrate of potash.—See "Nitrogenous manures."

Australian potash.—A local product, containing the potash largely in the form of carbonate. It contains about 25 per cent. potash, and costs £6 per ton. The potash is cheaper in this form than in any of the others, the cost per pound of potash in the form of sulphate of potash being 2¾d., whilst in Australian potash, the potash costs a little over 2¼d. per pound. The Australian potash contains, also, 4½ per cent. phosphoric not included in the above calculation.

Wood-ashes.—The potash in unbleached wood-ashes is in the form of hydrate and carbonate. If it is proposed to substitute wood-ashes for the sulphate of potash in the formulæ, a preliminary analysis must be obtained, as the potash-content varies very considerably in different samples.

Rust in Rye Grass.

Some time ago inquiries were received from the South Coast for advice as to the best means of treating rye grass affected with rust. Recently a dairy farmer at Mullumbimby, on the Tweed-Richmond railway, reported that the pest had appeared in his paddocks. Beyond burning off the grass periodically, and thus destroying the rust spores, as recommended in the case of the South Coast inquirers, there does not appear to be any ready means of dealing with the trouble. Of course, spraying the pasture with some fungicide like Bordeaux mixture would do a great deal of good, but it is doubtful whether one could do the work effectually, not to mention the cost of such an undertaking.

The Department is, however, anxious to do something in the matter, and will be glad to learn from any dairy farmers who may have observed the pest in their paddocks, any details they can furnish about the extent of the evil, with any information that can be supplied as to means, in addition to firing as recommended, that have been adopted to combat it, and the results.

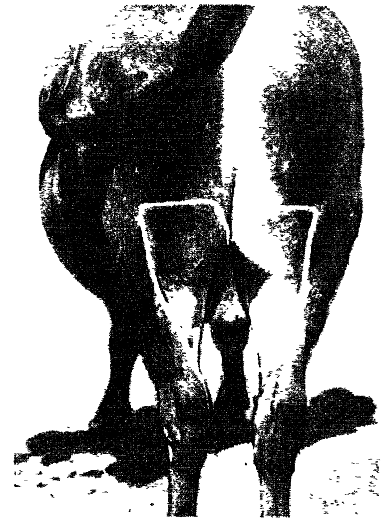
A Year's Experience of our Imported Cattle.

M. A. O'CALLAGHAN.

WHEN a man goes forth to purchase thoroughbred dairy cattle for breeding purposes, he has many points to consider. As stud stock have to be selected a great deal for type and character, and as some of the heaviest milkers are often not true to type, are perhaps ill-proportioned, it goes without saying that the breeder of pedigree stock has often to cast the best milkers. To breed from them would probably be productive, if heifers resulted, of useful animals; but if bulls resulted, the probability would be that they would be too ugly to fetch remunerative prices. Hence it is that the breeder of thoroughbreds often sells perhaps his best milker to some dairyman who is quite satisfied with her ugliness as long as she fills the pail. He does not want to breed bulls from her. When this Government sought to purchase cattle in Europe, they had in view the chief object of breeding bulls that would be representative of their breed, that would be sufficiently good-looking to please the eye of the intending purchaser, and that would have come from a strain or race of heavy milkers. This, then, was the task set the English agents who were appointed to make the selection. Bearing these points in view, and having neither cause nor desire to be partial in my criticism, I must say that, after a careful inquiry into the pedigree, merits, and demerits of the various animals, I have come to the conclusion that the agents did their work very well, and that the cattle imported are, as a rule, not only good-looking representatives of their several breeds, but are excellent dairy cattle. The cattle were two months at sea, and about two months in quarantine on a warm island, fed almost entirely on dry feed. They are scarcely yet acclimatised, and yet, notwithstanding, they are yielding, on the average, without any soiling or hand-feeding, more butter per head than any herd of cross-bred or thoroughbred cattle of equal number that I know of in this Colony, and we have some very good cross-bred milking herds in parts of New South Wales. The progeny are also very encouraging. Everybody who has recently seen these youngsters is highly satisfied with them, and inquiries are regularly arriving asking when any of the young bulls will be for sale. When the cattle were inspected by hundreds of our dairy farmers during quarantine period, the general opinion seemed to be: "The Jerseys are very good representatives of their breed; the Guernseys are a breed we have not seen before, but they look excellent dairy cattle; the Ayrshire cows are good, but we do not care for the Ayrshire bulls; the Shorthorns are no good, except one roan cow—all the others are too beefy; the Kerries look like dairy cattle, but we don't think they are any good for this

(2.) Escutcheon of Jersey Bull, "Melbourne."

(3.) Shorthorn Cow, "Pansy 4th."



(1.) Escutcheon of Guernsey Bull, "Rose Prince."

(4.) A Young Jersey Bull.

(5.) A Group of Ayrshire Calves.

(6.) A Group of Holstein Calves.

(7.) A Group of Jersey Bull Calves.

country." Such were the criticisms on these breeds. The Holsteins had not then arrived, and they were not included in the general criticism, but those farmers who have visited our stud farm are very well pleased with the appearance of the handsome-looking black and whites. When the animals arrived I picked the Guernsey bull "Rose Prince" as the best-looking sire of the lot. Public opinion has since confirmed that view. "Melbourne" I picked as the best of the Jersey bulls, but many of our Jersey breeders preferred the bull "Thessalian." The former was a year younger and did not look to such advantage as the latter, but now anyone with any pretence to knowledge of Jerseys can see that "Melbourne" is the better bull—in fact, I believe he is one of the best Jersey bulls living. The Shorthorns came in for the harshest remarks, and some prejudiced critics who, though they had never seen pure Shorthorns of a milking strain, condemned them severely, and used this as a lever to help to condemn the whole shipment. Only drink a glass of prejudice and the best judge is mad or blind. Prejudice is to the judge what jealousy is to the lover; it makes him see imaginary faults, and makes what would appear in any other man's eyes as honesty appear to him as dishonest and deceitful. The unduly jealous lover often shoots his lady and damns his soul; the prejudiced judge condemns the animal (man or beast) and damns his judgment.

I am afraid those who condemned the Shorthorns would, if they saw them milked, be forced to admit that they either knew nothing about Shorthorns as milkers or that they had had a very large glass of prejudice before journeying to quarantine island for inspection. Unfortunately, one of the Shorthorns, and, I am told by the men who came out in charge, one of the heaviest milkers, lost the use of two teats on the voyage owing to her being in full milk and having to go a couple of days without milking. Every dairy farmer knows that if a cow is a heavy milker, and that if she is left go even twenty-four hours without milking, she is almost certain to lose a teat or two. How many cows lose the use of some of their teats owing to being exhibited at our shows with over-stocked udders? Go into any dairy herd of any size on the Coast, and will you not see there, under the very eye of the master and owner, cows that, despite his carefulness, have lost the use of some of their teats? And yet many people look surprised, and talk a great deal of what they must inwardly know to be humbug, when they see one cow out of forty arrive after a two-months' ocean voyage with the loss of some of her teats. I mention and explain this matter because I do not think I would be doing my duty unless an answer was given to the many ungenerous and unsound criticisms on "the cow with only two teats."

I visited the stud farm at Berry this morning, where I found the cows looking much improved in their new quarters. Not alone are they looking well, but they are milking well; in fact, I think the smallest cow on the farm is capable of holding her own in many of our show-yards in butter-fat contests.

The little Dexter cow, although she has calved some time, gave 36 lb. of milk yesterday, testing 4·5 per cent. butter-fat, equal to a

yield of just under 2 lb. of commercial butter, a truly marvellous yield for such a little animal, consuming such a small amount of food.

Now for the yields of the Shorthorns :—

Red cow, "Lady Dora," yielded 56 lb. of milk per day for some time after calving. She is now giving 50 lb. per day, and her test is 3·8 per cent.

Red cow, "Pansy," gave 5 gallons a day for a long time after calving, and we had some difficulty in getting her to go dry.

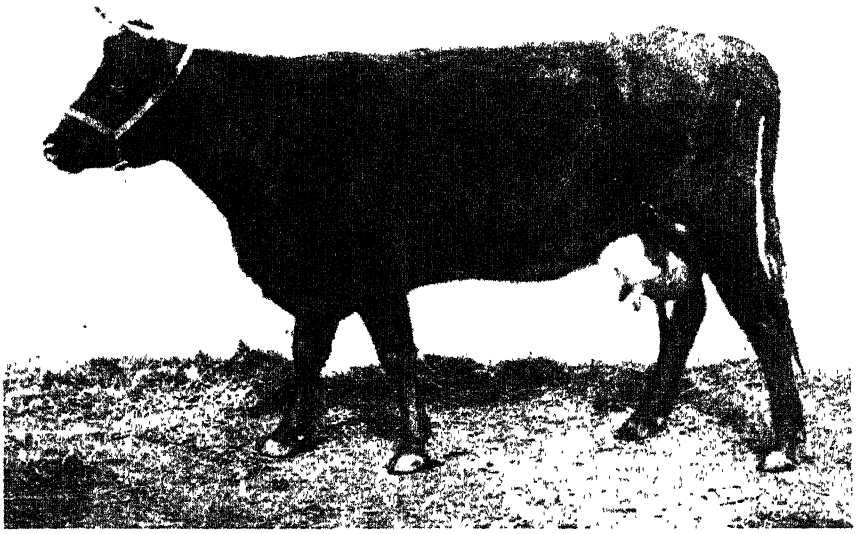
Red cow, "Fanny," is yielding just under 5 gallons per day, her yield yesterday being 48 lb.

Roan cow, "March Daisy," yielded 4½ gallons of milk per day when in full flow. This was the only cow of the Shorthorns that the bulk of the critics considered would be worth milking. One man, who is considered a great judge, wanted to bet me, when these cows were exhibited at Moore Park, that "March Daisy" would milk 3 gallons a day more than "Pansy." So much for his impulsive and unintelligent criticism!

Roan cow, "Honey 110th," is daily yielding 41 lb. of milk, and yet this cow was adjudged unable to feed a calf.

Of course, these Shorthorns fattened on the voyage out, especially as most of them were dry; but what a lot of our dairymen do not seem to understand is, that a Shorthorn cow, whether she is of the beef or dairy strain, will fatten if she gets a fair chance. When they are in full milk, they get thin enough, but any Shorthorns worthy of the name or breed will fatten if they are dry, and are hand-fed daily for a couple of months, same as these cows were on board the ship. That these cattle are beginning to be estimated at their real value may be gathered from the fact that that hard-working farmer, Mr. Rush, of Minto, has paid £55 for a yearling bull out of Fanny, which is the first one that has been offered for sale.

Herewith are some illustrations of these cattle not given already. No. 1 shows the escutcheon (marked) of the Guernsey bull, Rose Prince, and No. 2 gives a glance of the escutcheon of the Jersey bull, Melbourne. I will not here go into the detail of cattle escutcheons, or "milking mirrors," as they are sometimes called, but suffice it to say that now towards the close of the great nineteeenth century every intelligent person who has studied the matter believes that the young Frenchman Gueron made a remarkable discovery when he noted the relation between a cow's escutcheon and the quantity of milk she yielded. Without detailing the various varieties of escutcheons, it might be pointed out that the farther out on the thighs an escutcheon runs the better, or the larger, more regular, and more silky the escutcheon is the better. The escutcheons shown in these two illustrations are of two different varieties, and are both excellent. That of the Jersey bull, Melbourne, is highly remarkable and if there is anything in bulls' escutcheons this animal should get milkers. Illustration No. 3 is that of the red Shorthorn cow, Pansy 4th; No. 4 shows a young Jersey bull (now ready for sale); No. 5 shows a group of Ayrshire calves; No. 6 a group of young Holsteins; No. 7 shows three young Guernsey bulls; No. 8 shows the beautiful young Shorthorn



(8.) SHORTHORN COW, "FANNY 78TH."

(9.) SHORTHORN COW, "LADY DORA."

cow, Fanny 78th; and No. 9 illustrates that great Shorthorn cow, Lady Dora. Nos. 10 and 11 show two typical heavy-yielding Guernseys, "Lady Blanche" and "Vivid."

I have asked Mr. Quirk, who has been in charge of the cattle since their release from quarantine, for his opinion of the various breeds, &c., and I append same herewith. Mr. Quirk, who has been bred and reared a colonial dairy farmer, should be able to form a very sound opinion from a practical farmer's point of view, apart altogether from the question of breeding, of the merits and demerits of the several animals and breeds.

The Imported Stock.—Twelve Months' Practical Experience amongst Them.

P. QUIRK.

A good many people, before jumping to conclusions about anything, like to sit back a bit and see what sort of tale time will tell. That has been my position, because, although I have been reared among stock and have studied them all the time, I could form some sort of a notion of the imported cattle placed under my care, I resolved to watch the eight breeds closely and compare the results.

As heavy milkers, the pride of place rests between the Shorthorns and the Holsteins. Personally, I should give the palm to the Shorthorns. Now, I have been asked over and over again whether these inported Shorthorns are of a beef strain. I don't mind the question, for I freely admit that when I first saw the Shorthorn dry cows they looked a bit on the beefy side, but actual experience has taught me that as they came on, their tortuous milk-veins, wide escutcheons, and soft glove-like skins, were no misleading signs, for the milk-book kept at the stud farm shows a daily yield from some of them of 5½ gallons, on light grass feed—no beef strain about that—and I feel bound to say that on good pasture some of these Shorthorn cows would milk considerably over 6 gallons a day. If, as so many experienced breeders maintain, the dairy stock of the Colony are deteriorating, these are the cattle to use for the foundation of good herds.

The Holsteins are another wonderful strain of milkers with large milk-veins, wide behind, having capacity to carry a large quantity of milk. They are very docile, and have the quiet, leisurely stroll of all good milkers. This breed can also give their 5 gallons a day. They are almost on a par with the Shorthorns, still I favour the latter because they are such good "doers"—that is, can forage so well for themselves.

The Guernseys are a new breed of cattle for this Colony, and they have come to stay. No better proof of this than the invariable remark of visitors, "I wish I had a herd of them." They are handsome cattle with colours liked so much by dairymen, yellow and white. They are also a happy size, giving from 18 to 20 quarts a day of very rich milk. The Guernsey bulls should cross well with the large-framed heavy milkers. I have no hesitation in saying the Guernseys will be sought after and become the dairy cattle of the Colony for medium-sized farmers.

The Ayrshires are well known in the Colony, and a description here is needless. Those imported are hardy, good milkers—perhaps a little better in this respect than the Guernseys—but do not give the test in butter-fat.

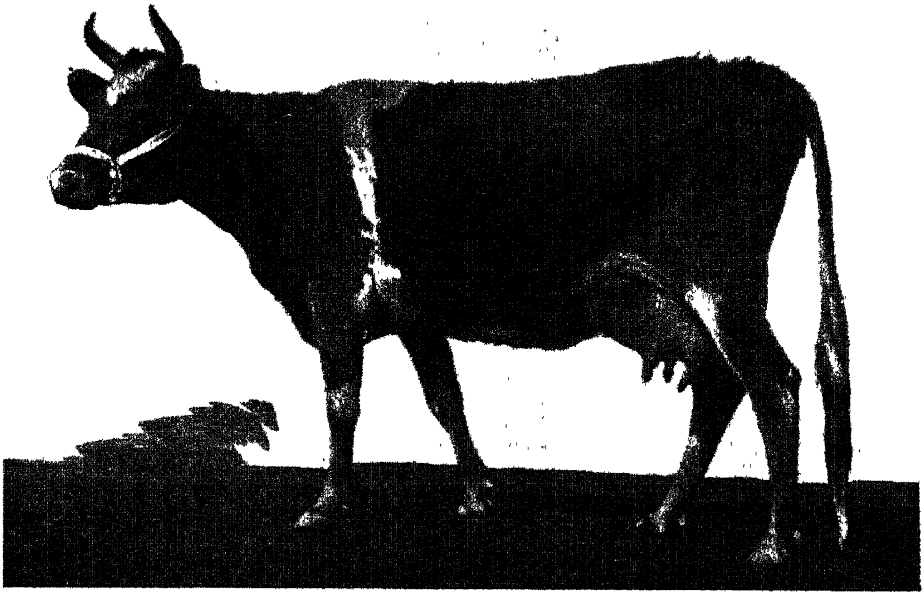
The Red Polls, of which we have only one cow, are a breed that the dairyman cannot pass over. I consider our Red Poll one of the best all-round cows on the farm, giving about 18 quarts per day at a 3·8 test. She is a pleasure to milk, and has plenty of room behind, running wedge-shaped. The Polls are of a happy size, and do on scarce pasture.

This carries me to the two breeds, Kerries and Jerseys. The former are but little known of in this Colony—the latter widely. In comparing these two breeds, I feel I am approaching dangerous ground, for there are so many Jersey fanciers and breeders. Still, after twelve months' experience, I must stand by the Kerries. These little cattle, I admit, require to be looked into closely before one sees their good qualities. I confess that at first sight I did not think much of the Kerries; but the more one sees of them the more favourable becomes the impression as to their sterling merit. The whole black colour does not enable you to see at first glance the milk-markings; but they are there all right. They are wonderfully closely-built cows, would easily outweigh a Jersey, have a large udder and teats, and plenty of room for milk with a high test. They are a quiet race of cattle, and one peculiarity about them I have noticed is that, when not eating, they are almost always lying down, thus showing their tendency to thrive. To sum them up, I would say that the farmer who keeps fifty Kerry cows would, in ten years, be prospering, when his neighbour with a herd of fifty Jerseys could not pay his way, supposing, of course, that adverse seasons were encountered. The Kerries, under ordinary conditions, could run away from the Jerseys; and I say this notwithstanding the celebrated Jerseys on this farm, including "Miss Lucy," winner of first prize at the London Dairy Show, 1897, and "Lady Tidy," with her long list of honours. I do not stand alone in this notion. I have first asked the opinion of one of the men who came out with the stock, and who, I consider, knows about as much as the next fellow. His answer was, "The Kerries would milk the Jerseys down."

The Dexter Kerries are truly wonderful little animals. The cow here gives $3\frac{1}{2}$ gallons per day, with a 4·5 test. They are the centre of attraction on the farm. From the farmer's standpoint they lack size as a dairy-cow; but for the man with a small paddock it would be harder to find a more suitable type, and it is a pity that more of them are not introduced.

THE criticism of the stock by visitors has been a little varied, but on the whole even those who contend that we have some local cattle equally as good admit that the herd does not belie connection with the best dairying strains of Britain and Holland, and all breeders with the welfare of New South Wales stock at heart appreciate the fact that in these cattle will be found the new blood and constitution so much needed to build up and maintain the health and utility of the dairy cows of New South Wales.

(10.) GUERNSEY COW, "LADY BLANCHE.



(11.) GUERNSEY COW, "VIVID."

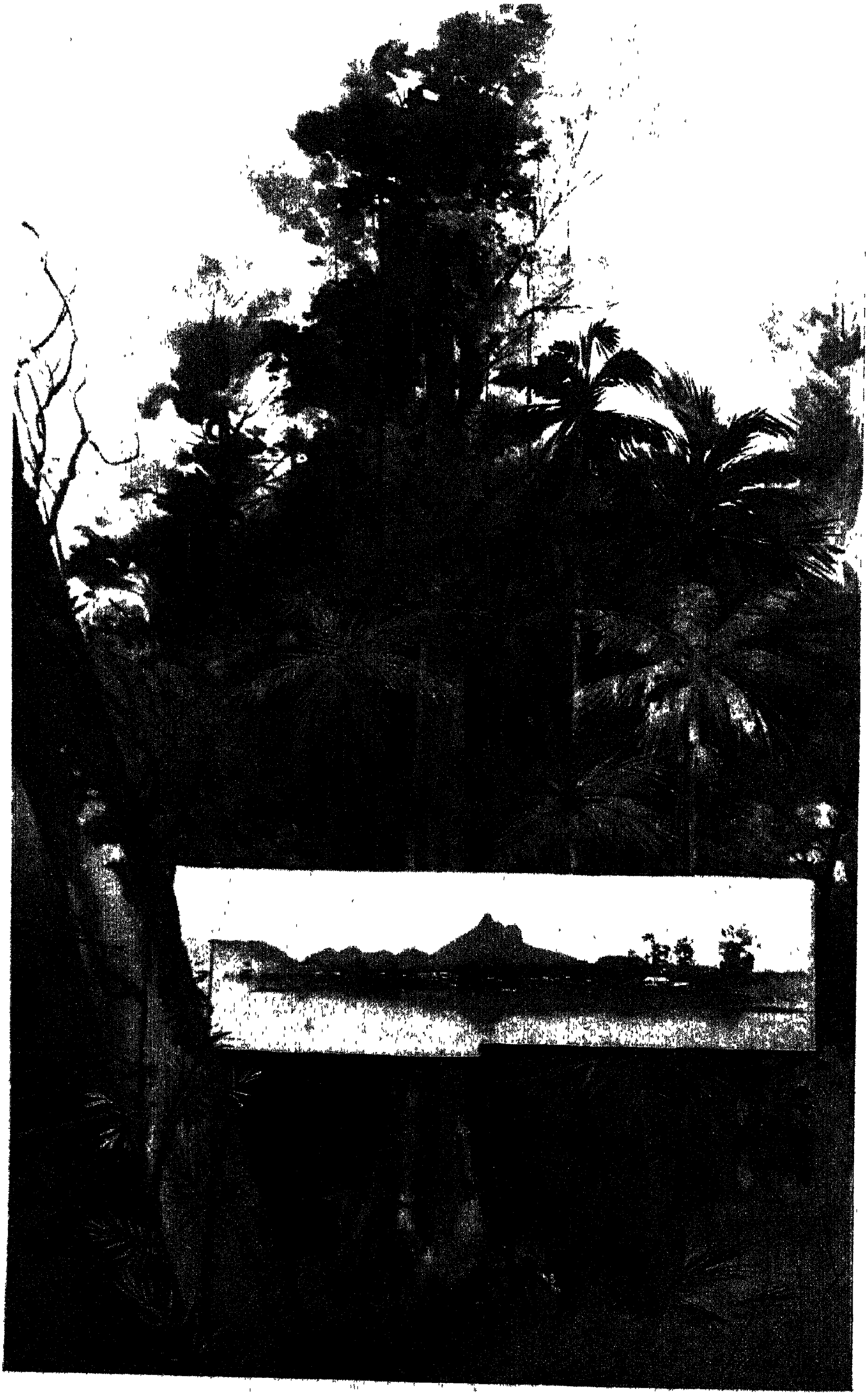


PLATE I.

1. A glimpse of the Big Scrub. 2. A view of Murwillumbah and Mount Warning.

The Industries of the North Coast.

W. H. CLARKE.

THE Big Scrub, lying between the Tweed and Richmond Rivers is an indescribable mass of luxuriant vegetation—everything choked and tied and festooned with creepers that twist and wind in long sinuous ropes to the very tops of immense trees. Waving above this impenetrable jungle, through which a leech might scarcely bore a passage, wave stately bangalow and other lovely palms. Here and there, as if to escape suffocation, great teak trees and giant boyans have raised their heads, in which innumerable parasitic ferns and robber plants find congenial lodgment.

It is thought that some readers of the *Gazette* will be interested to know how the great brush forests are swept away, and how the industries that have been established in this most remarkable portion of the Colony are conducted. In the chapter that follows, an effort is made to convey some idea of the nature of the country, and so on; but even with the assistance of so skilled an artist as Mr. Grosse, one cannot help feeling the hopeless inadequacy of words to express, or brush to pourtray, the manifold beauties and features of this most picturesque region.

So far as can be gathered, the first cane was grown on the Tweed, somewhere in the latter sixties. How the intrepid man who first laid a clearer's axe on the impenetrable jungle fared is not known. Doubtless, he had graduated cutting timber-getter's tracks, but he must have had an unenviable task. As a rule, in preparing the land for cultivation the timber is felled—ringbarking would be out of the question. In a space of about 1 acre it is easy to observe at least fifty apparently different varieties of trees, almost without exception softwoods, nearly all with whitish-grey smooth bark and many with great flanged boles. These flanges, about 2 inches in thickness and standing all round the stem like rudders, at times extend within a circle of about 10 or 15 feet in diameter to a height of 20 feet around a tree that at that distance above ground is about 2 ft. 6 in. through. To avoid the flanges and also to get up out of reach of the thorny undergrowth, the timber-fellers use a pair of boards, called spring-boards (made of cedar on account of the secure foothold it affords) about 4 feet long and 6 inches wide and 1 inch thick, fitted with an iron grip. A nick is cut in the tree as high as can be reached from the ground and the board set in. As soon as the pressure of a man's weight is applied the grip catches securely. Standing on the first board, the feller cuts a second nick and puts the second board in. Then standing on that he cuts another nick, and so on until he has

reached the desired height, and there he stands and plies his axe—sometimes 20 feet above ground—in the most nonchalant manner. As a rule, a gang of men contract to fall timber, and all hands with their spring-boards go to work and cut half-way through about fifty or sixty trees in a line, more or less, with a large one with a tendency to fall the right way. When everything is in readiness for the fall, the "boss" puts the finishing strokes to the "driver-tree," and as it begins to "speak" he jumps to the ground followed by the boards, which fall when the pressure is released. Then as the great tree, suffocating perhaps in the grasp of a parasitic fig with a head bigger than its own, and manacled and lashed and bound in all directions with trailing ropes, begins to tear free from its bonds and fall, the half-cut trees commence to sway, and one pulling another by means of the festoons of creepers, the whole mass is soon on the move. The grinding and crunching, and splitting and rending, with every now and then a tearing rush and fearful thud, is like Pandemonium let loose. Long before the tumult has subsided the "boss" may be observed in the mêlée, nicking a tree here, and hacking a vine there, to ensure what he will tell you as he afterwards gulps down a billy of jet black tea "is a blooming good fall," because, at about 25s. an acre at the most, there is not much in the game now.

The trees are left just as they fall, and in about three months time—say the felling is done in spring or early summer—the wilderness is fired. This operation clears up the heads, branches and undergrowth, and leaves the logs and stumps standing, charred and hideous, in hopeless confusion. If intended for cane, no time is lost after burning off to get the sets planted out among the dead timber. [Plate II.]

On some of the flats, and higher lands too, there are hardwood timbers, and these are ringbarked, while occasionally a huge teak tree will be reserved for milling purposes. Where the timber is ringbarked, it may be many years before the land is cleared, but in the class of country just described after about four seasons the majority of the stumps (Fig. 3) can be burnt out. Meanwhile the cane-planter does the best he can, and his first crop of cane has generally a fearful struggle with endless varieties of weeds that spring up as if by magic as soon as the ashes grow cold. Where these weeds come from is a mystery. On the soil of the standing brush scarce a sunbeam has ever played, and, so far as can be seen, there is no grass or herbage at all in the tangle of creepers and palms. Nevertheless, they come up smiling all round, and do their level best to obtain complete possession of the land.

A cane-field in the first stages of its existence, what with rank weeds, gaunt bare trees, logs and stumps of all heights and sizes, is not by any means a pleasant sight. [Plate III, fig. 1.]

On some of the alluvial flats, where cane has been grown for many years, and the last vestige of timber has rotted away, the crops are, however, in striking contrast to those on the partially-cleared lands. Sugar must of necessity be a very heavy crop on land, and although the fertility of some of these river flats is well-nigh inexhaustible, still the perpetual cropping with one plant must make the land sick. At

PLATE II.—CLEARING.

1. Showing how the land looks after felling. 2. Burning off. 3. Ready for first crop.

PLATE III.—SOME CROPS OF CANE.

any rate, on flats that would grow almost anything from the looks of them, there are crops of weed-choked tousled cane which will cut about 15 tons to the acre. An occasional change of crop, and the more liberal use of horse-cultivators (which, in the clear land, would be possible) would effect a wondrous change in these poor old tired farms. [Plate III, fig. 4.]

Lantana—a harsh, tangled scrub, with square-edged prickly stems, and a variegated flower—has become a widespread curse. On the banks of the Tweed this fearful plant, which a certain Major Innes is alleged to have nurtured so tenderly as a beautiful flower from Mr. Baptiste's garden, has taken possession of several cane plantations. The wilderness shown [Plate IV] was not long ago one of the finest and most promising plantations on the river. Yard by yard the Lantana (the seed carried by birds that feed on the rather pleasant-flavoured berries) encroached, and, before the farmer quite realised it, the weed, 10 feet high, had spread in a mass dense and solid enough to drive a team over throughout his plantation, and finally crowded him out of the gate and bunged up the gateway. Now, when one has cut his way through the thicket, the remains of the little homestead jut in desolute ruin from masses of the plant. A few valiant old peach and lemon trees are still holding their heads above the jungle, but they cannot escape strangulation. On another holding, near the Brunswick River, a farmer is endeavouring to grow cane on the little spaces of ground still uninfested with Lantana, but it can easily be seen that it will be only a short time before he is crowded completely out. The trouble is, no one—not even those who consider the plant a soil-improver—seems to have any idea as to a method of getting rid of this pest in a way at once economical and effective. The general opinion is that it is almost as costly to get rid of the "tomcat bush" as to clear original scrub. The luxuriance of weed-growth no doubt gives the young Lantana seedlings a chance to become well-rooted before any action to destroy them is taken. The best thing for the farmers to do would be to restrict their areas to a size which they can manage to control and thoroughly cultivate.

Sida retusa, or Paddy's Lucerne, is also at home throughout the district; but it is not such a bad little cuss after all, for wherever the writer saw patches of it the plants had been well eaten down by cattle, which are fond of the mucilaginous leaves.

On the way from Murwillumbah to Lismore the view from the train is obstructed for miles by weeds on the trackside. The worst of them is called "Stinking Roger," and it is a horrid pest, for which it is said we may thank South America. In some of the cane-fields the brown, dusty-looking stalks of this weed stand thick as a crop of wheat, feet higher than the cane. There are other weeds—the Ink-weed, Wild Tomato, and the all pervading Scotch thistles.

On the hill sides and back lands the cane appears to be better cared for. Perhaps in some instances distance lent enchantment to the view; but on hillsides, near the Tweed, there were great patches of cane in orderly drills gleaming emerald in the afternoon sun, in striking contrast to the forlorn crops on the flats. [Plate III, figs. 3, 4.]

At some large plantations between Alstonville and Rous, through which we were conducted by Mr. McBryde and Mr. Gordon of Rous Mill, most of the land, is pretty well studded with stumps and patches of loose stones of trap formation; but in one plantation, in which Mr. McBryde said the very best crops of cane were obtained, there is positively no soil visible, the whole area—two great undulating slopes—being covered with boulders, varying from the size of one's fist to about a foot square. They lie like a rock mulch on the surface. Lines are struck out and the sets are placed in holes scraped out with a mattock. Then, as a rule, the stones are kicked back and the plants force their way up and thrive amazingly. Anything in the shape of cultivation is, of course, out of the question; indeed, if the inventor of scarifying implements, such as the Top-notch or Planet Junior, which are now so much in vogue in other parts, were to see such a place, he would think he were suffering from the effects of lobster supper. Weeds find root-hold somehow and grow apace. The only way to get rid of these is to pull them out by hand, and this has to be repeated until the cane plants grow strong and luxuriant enough to smother out the weeds. [Plate IV.]

Harvesting and Transport.

The cane season lasts from June to December. There is no absolutely fixed period for canes to reach maturity—so much depends on the season and other influences. As a rule the heaviest crops are taken from plantations of about twenty months old. Then from the roots a second and perhaps a third rattoon crop is taken in successive seasons. After that the field is replanted in spring time with sets (little pieces of ripe stalk with bulgy eyes), placed in straight rows about 6 feet apart as a rule.

The harvesting of the crop is an enormous undertaking, and is generally a matter of arrangement with the contracting mill proprietors. According to the quality of the cane, as shown by recognised tests, a price is fixed at per ton, and the Company makes arrangements to transport the stalks to the mill by means of tramways, railway, river droghers, or bullock teams.

When a plantation is to be harvested, a gang of men (usually contractors) strip the cane—*i.e.*, lop off all the superfluous stalks and leaves; then it is cut. [Plate V.]

Gangs of cane-cutters, as shown in the illustration, are at work in a field studded with innumerable stumps. The operation of cutting is performed with a curious knife, with an exceedingly sharp edge and a little hook on the back. The cutter slashes down a stool of cane in a few vigorous strokes, severing the stalks right flush with the surface. Then with the hook on the back of the knife he picks up a cane, holds it bottom upwards and with a single slash severs the top. The bare stalks are thrown in a heap ready to be carried to the trucks.

It is said a gang of good men can each cut, top and load about 6 tons of cane a day. Everything depends upon the condition of the knife. As a rule, the cutter carries two knives—a new one purchased for the current season and only used where the ground is free from

A view of a cane plantation, showing how the boulders completely cover the surface.

An abandoned cane plantation overgrown with lantana.

PLATE IV.

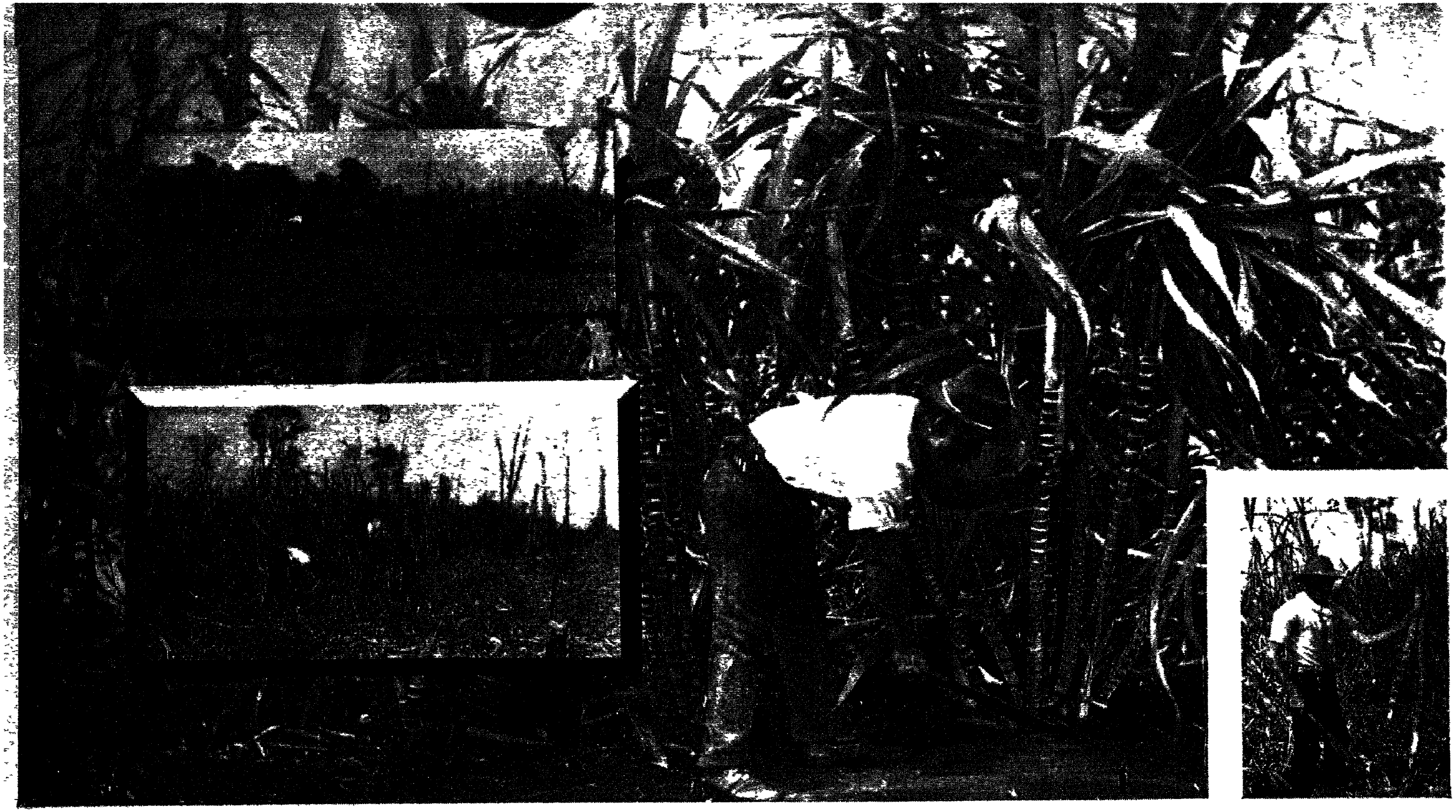


PLATE V.—HARVESTING.

1. Cutting, in a stud plot at Wollongbar Experiment Farm. 2. Lopping the heads, Rous Mill Plantation. 3. Cutters at work. 4. Loading tram trucks, same plantation.

stones, and one that has seen a previous season's service, which is availed of when the ground is bad. They are sharpened with a file, and a man might easily slice his foot off with one.

Road-haulage, especially in the wet weather that so frequently prevails in the semi-tropical districts, is fearfully heavy; and when one sees the places from which they draw these immense loads, he is amazed at the stamina and endurance of the little bullocks that are generally used. [Plate VI.]

This preference for small beasts is general among the teamsters, and the condition of the animals is remarkably good. In one of the cane-fields a team were busily engaged chewing cane-tops and odd scraps of cane; and this, Mr. McBryde informed us, is the staple food of the bullocks throughout the season.

Any one who is anxious to hear "Bill the Bullock-driver" rend the atmosphere and make the landscape shimmer blue in lurid blasphemy, would be rather disappointed in the Rous millyard. The teamsters are really splendid specimens of mankind, and in the intricate manipulation of their teams to weigh in and tip the loads, the only sound one hears from them is an occasional "Come-ee-woa-back-now," with a swirl of the whip to start the team, a flick to turn it, and an upraising of the whip with both hands to stop the animals. While we were there one man used a good deal more whip than "nous," and it certainly appeared to take him longer to make his team carry out his wishes with the butt end of his whip than it took the rest to effect with a "Now! Come-ee-ah."

On arrival at the mill the bullock-teams—some of them nine or ten yokes—dump their great loads of cane into a depression, from which the carriers convey it to the mill. [Plate VI, fig. 3.]

The place is so arranged that after passing over the weighbridge the team is hauled round to the edge of the hollow, and in some cases half a dozen yokes of bullocks are hitched on to the side of the waggon to force it down the slope. It strikes a sort of wooden buffer with a terrible thud, and the driver releases a bar which allows the body of the waggon to slide back and tip up. Then the waggon is hauled out, leaving the load in the pit. Several men—as a rule recruited from the travelling population—are employed to throw the cane on to the carrier, which works in a similar manner to that described lower down at the Condong Mill.

Throughout the crushing season of about six months (June to December), and all day long—week in, week out—teams are arriving with loads of cane.

For this inland mill a great deal of the cane comes in by bullock-teams; the rest is brought in by means of tramways laid into the plantations. The rails are made up in sections, and are laid on the trash in the field, following the cutters as they work through the crop. A team of bullocks haul the trucks which carry about 30 cwt. of heavier kinds of cane out of the field, and then they are gathered up by a locomotive which is kept for the purpose. [Plate V, fig. 4.]

One of the views shows this locomotive bringing in a train. The dog seen in the picture is an animal of many responsibilities. He

has voluntarily taken charge of the locomotive, and journeys back and forth with it wherever it goes. He condescends to recognise the driver and other people about the place, but reserves all his affection for his iron charge. If a horse or cow gets on the line the dog drives it off.

The trucks are left some distance from the mill, so that they can be passed over a weigh-bridge ; then they are drawn to the carriers and emptied in a way that will be described later on.

A lot of cane is grown in the district traversed by the Murwillumbah-Lismore railway, and at many of the stations teams of all kinds, with great loads, were crowding the yard. A sort of immense gallows is erected, the truck is pushed under it, and by means of a curious crane, worked by a horse, the loads are transferred bodily. [Plate VI, fig. 1.]

On the banks of The Tweed and Richmond and their tributaries, in all sorts of odd nooks and corners, are to be seen substantial little wharves [Plate VII, figs. 1 and 4] where capacious droghers moor to receive their cargo of cane. Some of the cane is brought to the wharf on teams, but the bulk of it is carried on tramways, which are laid by the Company right into the fields. From the hill-tops to the river-bank some of the trams come down places as steep as the roof of a house, the full truck hauling the empty one to the top.

A number of steam-tugs are busily engaged all the time towing the droghers to and from the mill, and we passed more than one busy little steamer which whistled indignantly for us to get out of her way. [Plate VII, fig. 3.]

Sugar Mills.

There are a number of important mills in full swing in different parts of the district. Time, however, did not permit of seeing them all, so the few details as to method of manufacture now given will be confined to the first one inspected.

A couple of miles below Murwillumbah—a prosperous little town that seems to nestle at the foot of Mount Warning—and past the ferry, which is soon to be replaced by a bridge worthy of the business necessities of the place [Plate VIII], is the C.S.R. Co.'s Condong Mill. [Plate VII, fig. 5.]

Mr. Helms, the manager, courteously conducts us through the establishment. Commencing with the droghers at the wharf, Mr. Helms explains how the cane is brought to the carrier—a great endless belt made of wooden battens—about 5 feet wide, running from a sort of trough to the shredding and crushing machinery. On each side of the trough a cane-laden drogher [Plate VII, fig. 2] is moored, and men throw the canes evenly on the belt, which revolves slowly, and is at times stopped to prevent choking of the shredding appliances. As the cane is carried up it is toppled on to the shredder, and falls from there, commingled with water, on to the crusher No. 1. The juice flows away beneath, and the woody matter is elevated to a macerating-tank, and again passed through powerful rollers, which crunches out the last possible vestige of juice. Then the waste matter, called megass, is carried away by means of an elevator to a loft from which it is fed—down shutes—to the furnaces. Sometimes this megass is used for applying to soils to improve the mechanical condition, but it is found that the easier

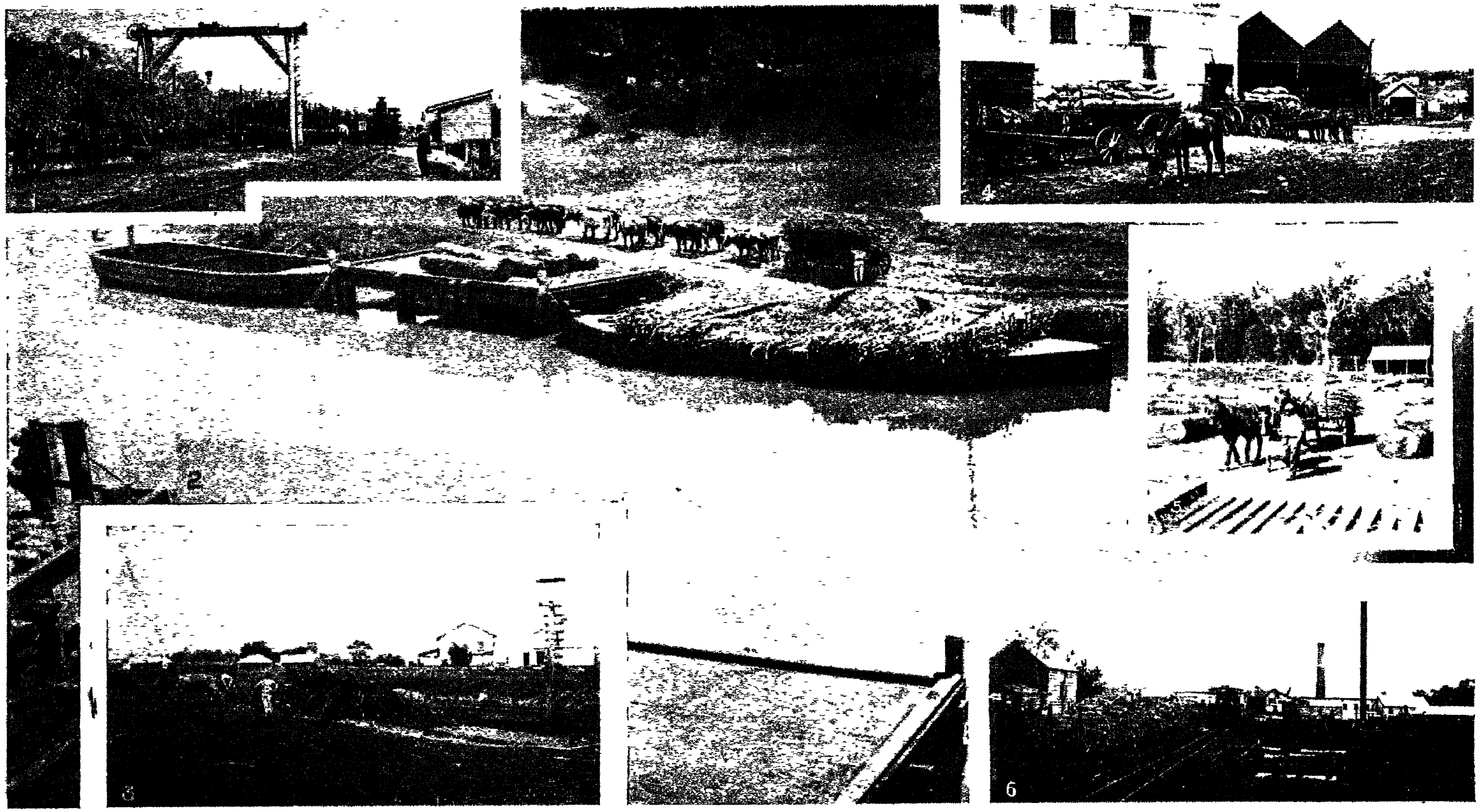


Plate VI.

1. Loading trucks on the Murwillumbah-Lismore Railway. 2. Loading droghers at Lismore. 3. Dumping the load at Rous Mill. 4. How the sugar leaves Rous Mill. 5. A little load of cane. 6. Locomotive and trucks at Rous Mill.

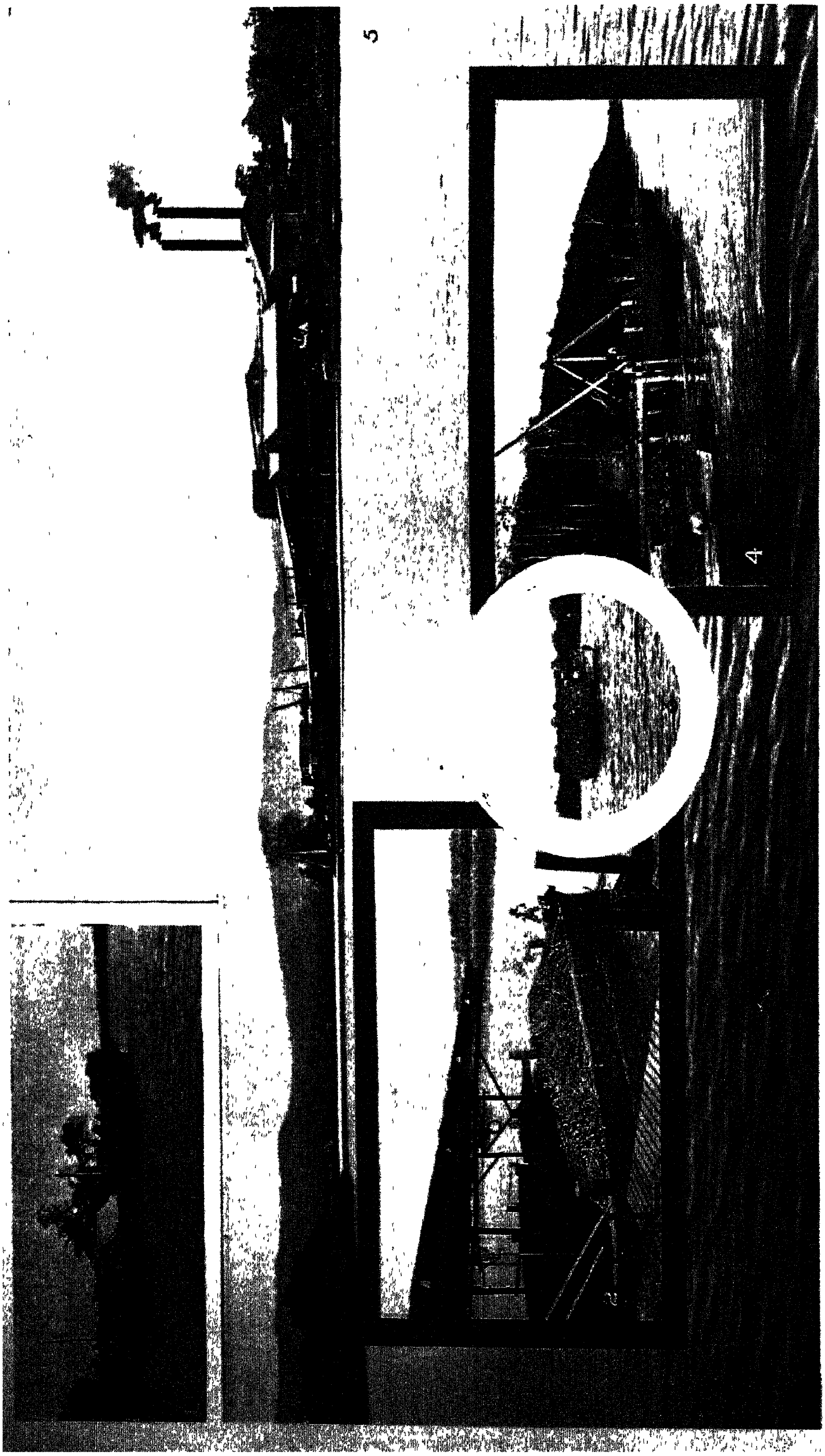


PLATE VII.

1, 4. Wharves at which cane is loaded. 2. Droghers discharging into carrier at the mill. 3. *En route.* 5. The C.S R. Co.'s Condong Mill, Tweed River.

and more economical way to utilise it is as fuel. The juice from the rollers pours down channels—the stream from the first crushing being far more copious than from the second—and into a reservoir, whence it is raised to vats in the next storey. Here it is heated to boiling point, and lime is added to precipitate organic matter mechanically suspended in the juice. A quantity of waste matter is also cast to the surface, and this is skimmed off by the men in charge of the vats. After a couple of skimmings, the hot juice runs into the subsider—a huge vat on the ground floor. It is left in the subsider a little while to enable any dirt to settle down to the bottom.

Meanwhile the refuse from the skimmings and precipitation, with a little more lime added, is passed through the filter presses—queer contrivances in which enormous pressure is effected by means of screws turned by wheels very much like those used for steering vessels. The presses are not unlike concertinas in construction, and at each bulge or segment there is a tap—a regular regiment of taps—opening over a little gutter, from which any juice extracted runs into the subsider. The residue is a dark, slightly moist mass of material, called filter-press muck, which, on account of the lime it contains in the first place, and of the organic matter, is a comparatively useful fertiliser and source of soil-humus. The juice is taken from the subsider to the evaporators (on the top floor). These are huge vats, in which the juice is raised to boiling point again, with the object of driving off, in the form of steam, the water that has been added in maceration and is contained in the juice itself. The juice (or solution, as it is called) goes into the evaporator at 16° Baume—*i.e.*, according to an appliance for determining the density or percentage of sugar—and passes through a series of four evaporators. In each evaporator there is a sort of window, in which the solution can be observed boiling furiously. Provision is made for the removal of samples for testing. This is roughly and generally done by means of little bottles on a stick, all that is necessary for the experienced eye being a glance at the sample. On emerging from the fourth and last evaporator the solution has become a fairly thick syrup, and is passed up into the vacuum pans. The effect of this process, under which the heavily saturated solution (that is, heavily laden with sugar) is exposed to a lowering temperature, is to bring about crystallisation. This is a statement that needs considerable explanation; but, for the purpose of this article, it is, perhaps, sufficient to say that a dirty-coloured, faintly brown, fluent syrup goes into the vacuum pans and a very much darker, gritty-feeling mass comes out of the last pan, with the consistency of home-made toffy, and a tremendously sugary odour. Mr. Helms was good enough to cause a couple of samples to be withdrawn from the vacuum pans. The operation is a peculiar one. The operative introduces into a small hole a rod-like appliance, and on the end of it, when withdrawn, there is a little clot of incipient sugar. This is placed on a small square of glass, and one notices in the sample from the first pan that the substance is of distinctly darker colour, and the crystals can be felt by rubbing the finger through it. From the second pan it is darker still, and the crystals are more pronounced; and so

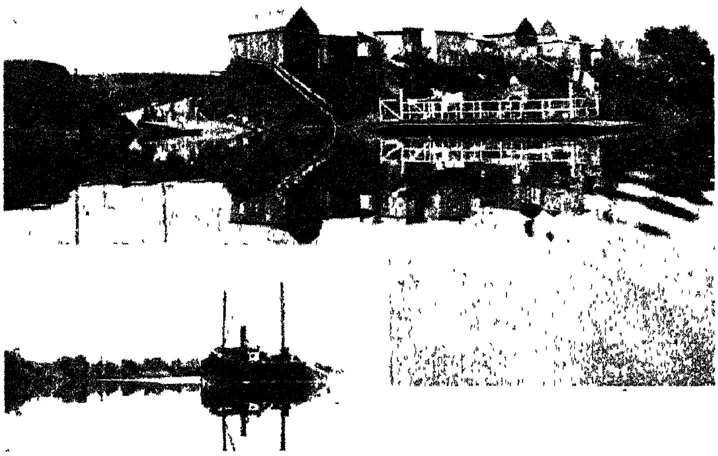
with the last pan. From the vacuum pans the treacly mass is passed into an immenes vat on a lower floor, where it is allowed to cool, and a sample is taken for analysis.

All being well, and the mass sufficiently cooled, it is allowed to run or flop into hoppers, in which it is carried on a "bogey" (or sort of railway in which the hopper hangs suspended from the rails) to centrifugal appliances—a new process. The mass drops into a sort of cream separator, and is whirled around with the greatest possible speed. The effect of this is to cast the crystals into a sort of funnel and the residue into a separate chamber. The sugar is taken off in barrows pushed beneath the centrifugal appliances, and thrown into a hopper in the floor, from whence it is elevated in a brownish-yellow stream to a funnel, down which it drops into bags which hold 2 cwt. Then it is sewn up—each mill having its own coloured sewing-twine—and shipped to Sydney, where it is refined. The refuse from the centrifugal appliances is boiled again, and a certain percentage of sugar is extracted. What remains is so low in sugar that it does not repay the cost of further treatment, and is called molasses.

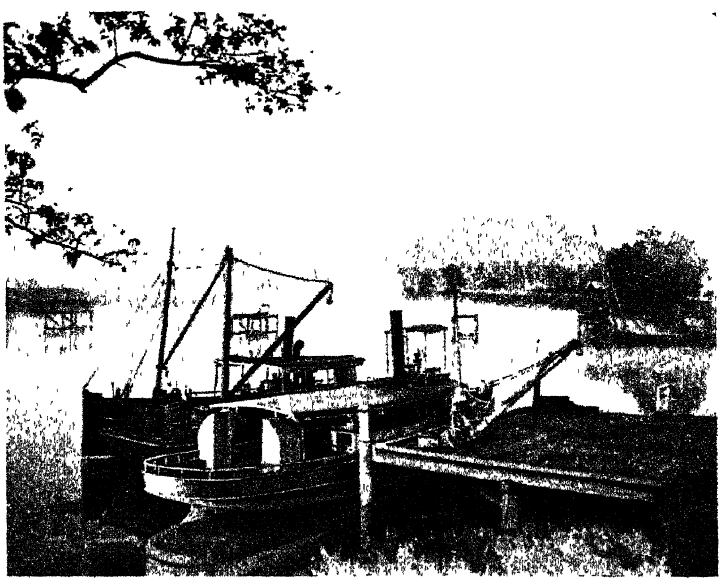
From Condong Mill the sugar is carried down the river in droghers to be transhipped in the coastal vessels for Sydney; but from the Rous Mill, which may be regarded as a typical inland mill, the sugar is loaded into horse teams for conveyance to a port of shipment.

Late frosts make great havoc among the cane crops. As a general rule one does not look for much harm from frosts on elevated slopes; but in the Richmond River district, cane growing in places where one would never dream of finding frost-bite, is ruined, or gets such a set-back in the latter part of spring that it is unable to hold its own against the depredations of disease. As a matter of fact, it is only on the very stony ground that decent crops can be obtained with certainty, and although in the field many of the varieties commonly grown may look most promising, it is found in the mill, and by systematic tests, that their sugar-yield is disappointingly low.

For the first evil it is beyond question that the rapid opening up of the country is to a great extent responsible. It is a matter to be greatly deplored that, in their anxiety to make what at first thought is the most out of their land, the farmers of the north-eastern portion of the Colony are destroying all the shelter-belts, and leaving the country as bald as a billiard table. The future consequences of a practice so pernicious are terrible to contemplate. It does not do to let Nature have her own way entirely, but the moment we fly in her face we pay for it bitterly. And this is what will happen in this place. With the change from luxuriantly clad hill-tops and sides to uninterrupted stretches of open country, will come the unrestricted and disastrous sway of winds, lessened effects of rainfall, certain interference with water sources, and washing of the hillsides. And if all this were not enough to make one reconsider the wisdom of destroying all the natural timber, there is the crucial question which has already been negatively answered in other parts of the Colony, as to whether the exotic grasses which now comprise the pastures, and thrive so well in their comparatively sheltered nooks, will long survive when all the



The Murwillumbah Ferry, with a view of a cargo drogher.



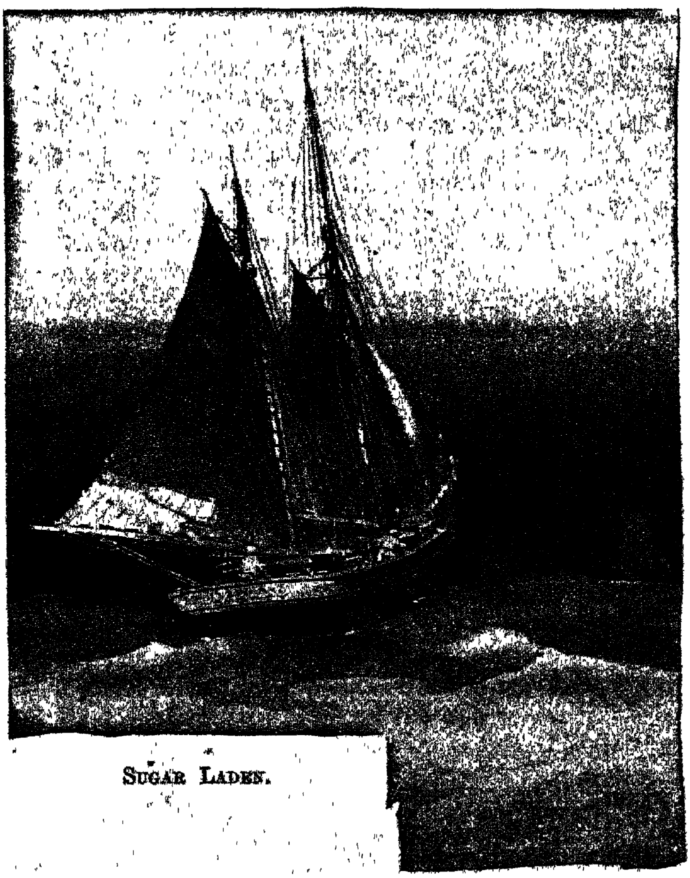
The Wharf at Murwillumbah. All the piles for the bridge, as will be noted, are in position, and the bridge will soon be ready for traffic.

PLATE VIII.

four winds of heaven have full play upon them, and the heavy dews and frequent showers have disappeared with the forests that engender them. From the nature of the trees, the indigenous forest can only stand in large patches; but there is no reason why the second growth, or perhaps trees better fitted for the purpose, might not be allowed to grow where necessary.

As to the low sugar content, it is pleasing to observe that at the Rous Company's Plantation, Mr. Gordon has quite a large area set apart to grow for stud purposes and trial new varieties of cane from New Guinea and elsewhere, supplied from the Wollongbar Farm. These canes are most carefully tested in every direction, and those that prove to be of high quality are distributed by the Company to the farmers supplying them with cane. In this way already several new varieties have been introduced to the district with good results, and as time goes on it is anticipated a general improvement will be effected in the tonnage yield and sugar content of the cane in cultivation. The authorities of the other mills on the Richmond have also done a great deal of valuable work in the same way, and on several occasions encouraging reports from them have appeared in the *Gazette*.

So much, or perhaps to put it more correctly, so little, for the sugar industry. In next issue an effort will be made to illustrate and describe some of the most interesting phases of the dairying industry.



SUGAR LADEN.

Bee Calendar.

ALBERT GALE.

DECEMBER.

IN some parts of the Colony the honey harvest is well advanced. With me it is ten days earlier than last season. In the higher altitudes of the Colony, owing to the sudden and erratic changes in the temperature, the honey season is still backward. From the fruit-blooms there should now be a good flow in the warmer districts. The honey from this source should be stored separately, as it is generally of a superior quality.

Most bees have ere this thrown off their first swarm. Be satisfied, cent. per cent. is a good interest. The second and other swarms should be returned to the hive from whence they issued—that is, if the object to be attained is honey and not bees. If the latter, then hive every swarm you get. Remember it is the strong colony gives the return of honey, especially so if you are going in for sections. Swarms will constantly be thrown off till late in the autumn.

The beekeepers' harvest has fairly begun up northwards and other warm districts. At this season of the year you can extract almost every cell of honey, but it is not wise to do—there is nothing gained by so doing: Bees consume a lot of honey during breeding season, and the closer it is stored in proximity with the brood the better, for it saves time. Extracting should be carried on whenever about three-fourths of the frame is sealed over. Do not be to avaricious, especially towards the end of the season. I have known the honey cease before the end of summer, owing to climatic changes. "It is better to be sure than sorry." Therefore, always leave enough honey in the hives to carry your bees over till the next season. There is nothing to be gained by close extracting; bees always want honey. It is not so costly to store it in the hive as it is to store it in bottles or other vessels.

In uncapping for the purpose of extracting hold the frames so that the cappings below the knife will fall clear of the comb. Cut downwards, and take a long drawn cut; let the action of the knife be towards the operator. By no means take a saw-cut as if cross-cutting a log; such cuts always tear edges of the cells to rags; this entails a lot of extra labour on the bees. In putting the frames in the extractor place them so that the bottom bar of the frame leads in the rotary motion of the machine; in so doing the honey leaves the cells much more freely than if put in so that the top bar takes the lead in the circular motion.

Remember I have said that comb to be extracted should be fully two-thirds capped. Uncapped honey is always unripe, and unripe honey has always a tendency to ferment. Honey can be ripened artificially. When in bulk, honey should occupy a warm position; this aids in the evaporation of the too great aqueous particles, and thereby hasten ripening and gives the honey a greater density.

Bees are passionately fond of water, and if it is not within easy reach they will travel miles to obtain it. Bees are also very fond of salt, and are often seen about the margins of brackish creeks, in pig-styes, and other places where salt is procurable, eagerly gathering it. Salt aids greatly in keeping the bees in health. If water be not handy, put some in tins within easy reach. Let some tins or other vessel contain pure water, others to contain a little saline water. Of course, that can be done by adding a little common salt. In each vessel of water place some bits of cork or buoyant chips for the bees to alight on.

Go in for queen-rearing, or purchase from a dealer of good repute for healthy bees. All useless and degenerating queens should be superseded. Like produces like, and good healthy queens produce good healthy progeny.

Dust Baths for Hens.

So long as the weather is dry fowls will find ways of cleaning the vermin from them, and taking their kind of a bath by rolling in dry earth, out of doors, if given the chance. It will usually be in the garden too, especially if one has made an especially mellow bed for the growth of the seeds that he regards as the choicest. The flower bed nicely levelled and smooth, and as mellow as an ash heap, is the hens' favourite place. But it isn't fair to blame the hens too much for what after all is the fault of her owner. The hen won't go into water and wash herself to keep clean. If a rainstorm comes on she coats her feathers with oil to cause the rain to run off and keep herself dry. Rolling herself in fine soil or coal ashes so as to fill her feathers full, and then shaking herself is the hen's way of keeping clean. If you will keep some fine soil in a large box under shelter, where it will be always dry, the hens will patronise that whenever they need a bath, and they will keep themselves free of vermin, which they cannot do in a wet time unless some such dust bath is provided. Coal ashes are finer than road dust, and are therefore better. Some should be kept for this purpose. It may be well also to have another box with dry earth on top and some moist earth below for use in extremely hot weather. Hens are very sensitive to heat and one of the reasons why hens prefer to take dust baths in summer is because by digging down to roll they will find moist, cool soil to roll in. Therefore in summer, the dust bath should be moist below with a few inches of dry soil on top.

Farm Notes.

NORTHERN RIVERS DISTRICT.—December.

H. V. JACKSON.

Maize for ensilage may still be sown; early or quick growing varieties will be best.

Sorghums can also be sown for green crop and for the silo.

Land intended for potatoes or other root crops, and which has been under green stuff as a manure crop, should now be ploughed in, and so give time to allow the land to lay fallow for a little while before sowing the future crop. At the farm rape has been found a rapid grower as a crop for ploughing under, and more certain than the cow-pea; under certain conditions the cow-pea comes very slowly here, though when a crop is obtained the growth of green stuff is prolific.

Seedling vegetables will require to be raised under shade of bush frames or calico during hot dry weather, uncovering at night and in cloudy or wet weather. Some cultivators will have onions fit for marketing and potatoes fit to dig.

If moist weather is being experienced, sowing of *Paspalum dilatatum* grass and *Panicum maximum* (the Guinea grass) may be continued. The seed of Guinea grass is somewhat scarce, and roots may have to be obtained to make a start with it. Plant fair-sized roots, and press them down well in the soil when planting. In localities subject to severe frost the Guinea grass will not stand—at least, that is the experience here—but where frosts are only mild, it may dry down in the winter, coming again in the spring, and gradually increasing in volume right through the summer, luxuriating whether wet or dry, keeping remarkably fresh and green even under droughty conditions.

When sowing *Paspalum dilatatum* at the farm 5 lb. of seed is mixed in 20 or 25 lb. of sawdust, and that bulk quantity of seed and sawdust is sown to the acre, the sawdust acting as a medium whereby the spread of seed is obtained.

Salads are a great luxury during the hot weather, and with discreet shading lettuce, endive, and tomatoes should be obtainable. In some gardens there is considerable loss of tomato crop through insufficient shade, and the absence of stakes or trellis to support the plants. If much rain is experienced disease may attack the tomatoes, and if no shade is provided the fruit scald under continued exposure to the hot sunrays on clear days following the rain. If any tomatoes show signs of blackrot, in the shape of a dark-coloured blotch on the blossom-end of the fruit, pull such fruit and burn it, and spray the plants with Bordeaux mixture.

If pumpkins, &c., shows sign of blight or pumpkin-leaf oïdium on the leaves, dust the plants with powdered sulphur, both over and under the leaves. Pineapples and bananas may be planted, and ground should be ready to plant out coffee seedling trees if seasonable rains are prevalent. The coffee-tree requires shelter from too much exposure to wind and frost.

Plough up all vacant plots of ground so soon as the crops are off, and keep growing crops as clean as possible.

Look to fruit-trees, and by finger and thumb pruning check the production of too much useless young wood.

Look out for caterpillars on the vines, and watch for oïdium, sulphuring promptly if there is any sign of it.

Look out for scale on oranges and lemons, and on fruit-trees generally. If the wood appears to rise well, some budding of stone fruit-trees may be attempted. Tropical fruits, such as mangoes and paw-paw trees grown in pots, may be planted out if the weather is showery. On bright days the plants must be shaded until thoroughly established. Strawberry beds will probably require a protecting mulch and some watering in dry places, or during a dry time. Some small cultivators have been very successful with strawberries in this locality, and they are a very useful paying adjunct to other crops if properly managed.

If the weather has been showery, or if in the absence of rain the rhubarb plants have been supplied with sufficient water, and a good mulch of manure was made, then some good stalks of rhubarb should be now obtainable. In localities where fruit is somewhat costly, or at times scarce, rhubarb should be more generally cultivated, and sold at moderate prices—it should not be so much of a luxury to obtain, as it appears to be. The following interesting notes on the rhubarb plant are from an article in Chamber's Journal :—

"Through the eating of rhubarb the stomach is highly stimulated and all the intestinal juices excited to good action; the salts enter the liver and the blood, doing excellent work in both; the acids, by inherent astringent property, clear away all unnecessary and unwholesome mucus, overpowering and neutralising all weaker acids of noxious nature generated in the tissues; and the alkalies aid the bile flow and help the pancreatic juice to do its work of fat emulsifying. Thus rhubarb labours in the human organs, every one of which receives its benefits abundantly.

The Rheum plant is a natural tonic that braces up the whole system—a general strengthening and purifying agent; and its good properties are brought out and improved by proper cooking. Especially does rhubarb prove a good friend to the owner of a bad skin, for it has a peculiar property of tightening the relaxed and gaping pores, that yawn to receive the tiny stoppers of dirt particles ever afloat in the air, which, once caught in the pores, become unsightly blackheads a little later. If the blackheads be already present in unwelcome arrays of ugliness, the astringent rhubarb influence is able to expel them, causing a rapid increase of the skin action; thus it becomes a sure complexion cleaner, and, as a consequence, a beauty giver. Through stimulation of the liver, and by the bestowing of restored tone on that organ, this good food medicine can remove the dull look from the eyes, take the yellow tinge from the flabby eyeballs, which it renders firm again, and destroy the baggy, livid appearance that a slow working liver is want to bring under the lower eyelid. By taking the heaviness from the eye, it also takes the tired lines that would speedily develop into the wrinkle so dreaded as the age sign, though often it is more likely to be the signet set by weariness. Through the giving of salts much needed by the blood, that the vegetable scarcity of winter is apt to impoverish, rhubarb becomes a preventer of pimples, and scurvy itself would yield ground to it as quickly as to lemon juice. Skin blotches cannot long afflict the eater of it; and one excited well nigh into feverishness would find his system cooled deliciously and his

nerves soothed into restfulness by means of a long draught of life-giving rhubarb juice made palatable and sweet. For a gratefully acid and most cooling summer drink can be very quickly made when this good garden gift is especially plentiful, by infusing a couple of well crushed, raw stalks in a jugful of boiling water, which is then sweetened to taste and left to cool. This is rhubarb tea. Apple tea, which some prefer, is made in exactly the same way.

The inhabitant of far Eastern lands well recognises the sterling qualities of the Rheum plant, and thankfully accepts the gifts it has in store for the human body; and he puts it to splendid uses. From the Orientals, left by us so far behind in many ways, came the knowledge our doctors hold of the plant's medicinal properties; and they use the petioles extensively—especially those of R. Ribes—in the preparation of that most cooling and delicious drink sherbet, the making of which prevails throughout the Orient. Rheum its name is, rheum's enemy though it be, and that name was given because the roots and petioles were found to be sovereign specific in the curing of all rheumy, or mucous disorders. Anciently all ailments were ascribed to the flowing of rheum, or humor, through the parts affected, and that painful muscle ill we term rheumatism received its name because of this notion. It is uric acid generated in the blood that is the dire cause of the pangs endured by the rheumatic person, and this acid is neutralised by the alkaline matter contained in the rheum foe, and by the strong counteracting powers of its oxalic and malic acids. Any excess of limy matter or chalky deposits in the system can be neutralised by the same agencies.

Various are the methods of rhubarb cookery. A favourite dish with children is the petiole well sweetened, stewed with a little water, and flavoured with the peel of a lemon. Orange peel is a good flavouring for it, and cloves with rhubarb are found excellent. Rhubarb juice extracted, mingled bulk for bulk with water, and made into syrup, using therefor a pound of white sugar to each pint, makes a drink foundation of the best tee-total kind, and it will keep for a long while. Rhubarb wine is a strong intoxicant, as abstainers from spirituous drinks ought to know. The wine generates in keeping, through its fermentation, a really large quantity of alcohol, and when two or three years old is as cunning a betrayer of the unwary as ever was port wine.

In the flower garden, dahlias will be making good progress if plenty of moisture and manure is available. Gaillardias and coreopsis now make a great show. Cut away dead wood from rosebushes. Fuchsias growing in favourable and protected places will be gay with abundant flowers. Crysanthemums should be well looked over for caterpillars frequently.

During the wet weather that may prevail at this time, endeavour to keep pig pens and cattle yards as clean as possible. See there are proper channels made to run off any water that will otherwise form stagnant pools. Give a look to open plough furrows intended to act as open drains on headlands of cultivation areas, making provision for sudden rushes of flowing water that may arise at any time now from tropical rains. Especially look to these matters in the hilly localities.

RIVERINA DISTRICT—DECEMBER.

G. M. McKEOWN.

Maize

MAY still be sown for ensilage or green fodder.

The best soil for the production of this crop will be found in the black soils of our river-flats.

Deep ploughing is essential, and the soil should be brought into a fine tilth by means of harrowing.

An excellent implement for the purpose will be found in the Morgan Double-spading harrow.

Seed should for all purposes be sown in drills at 3 to 4 feet apart. All growing crops should be frequently scarified lightly with Planet junr. horse-hoe; and in these dry districts the plants should not be hilled, as the operation of hilling seriously injures the roots, and makes cultivation of the crop during its growth very difficult.

Trials are being made on the Wagga Farm of a number of American varieties, to ascertain if any may be found to suit the usual conditions prevailing in inland districts.

Results will be published in due course.

Sorghum

Should be sown without delay in well-prepared land, preferably river flats, in situations sheltered from hot winds.

Seed should be shown in drills about 3 feet apart, allowing 8 lb. to 10 lb. seed per acre.

The best varieties, so far, have proved to be amber cane, planter's friend, and kaffir corn.

New varieties are undergoing trial at the farm; but results as yet are inconclusive.

All growing crops should be well tilled with Planet junr. horse-hoe.

Millet

May still be sown, provided fair showers fall during the month.

The Hungarian and Japanese varieties will give the best results.

Seed should be sown at 12 to 15 lb. per acre, in finely-prepared land, and lightly covered with a light lever harrow.

The crop should be cut for hay before the seed forms.

Pumpkins and Melons.

The soil round the roots should be well mulched, and, where possible, supplied with water.

Where cultivated on a larger scale, keep the harrow or horse-hoe going between the rows as long as the size of the vines will admit.

Pinch off the ends of vines to promote a greater lateral growth, thus ensuring greater bearing capacity, and at the same time shading the roots of the vines from the prevailing heat.

Air-slaked lime or wood ashes dusted on the vines will prove an effectual remedy for beetles, &c.

Tomatoes.

Mulch and water as liberally as possible. All plants should be tied to stakes. The single-stem system, provided the upward growth is kept in check, and a liberal lateral growth is promoted, gives good results; but the most satisfactory method will be found in the use of three stakes to each plant. The stakes should be sloped well outward from the plants, of which three main branches should be trained, one on each stake. By this system ample protection is afforded the main stem and roots, and crowding of the fruit among the foliage is prevented. The liability to fungous diseases is also decreased should the season prove moist.

HAWKESBURY DISTRICT.—DECEMBER.

BY GEORGE VALDER.

Maize.

The late crops should be got in as soon as possible; if seed is procurable, sow the quick-maturing varieties. The season, so far, has been a good one for the early crops, and, as the land is in good condition for getting in the late crops, there is every prospect of a heavy yield of maize.

Maize for ensilage can still be planted largely. Regarding the best varieties for ensilage, there seems to be a great diversity of opinion. In some districts the tall-growing varieties are considered the best, whilst in others the shorter and quick-growing varieties are mostly in favour. This is a matter that the farmer will have to decide for himself. The best plan is to choose the variety which matures good cobs, but at the same time yields a heavy crop of stalks, which should be covered thickly with leaves.

Table Maize.

This splendid vegetable is still much neglected, and yet in our principal maize districts it should be one of the chief summer vegetables. The Sydney seedsmen offer seed of several first-class varieties, and, as it requires the same cultivation as the ordinary maize, there is little difficulty in growing it. The crop, however, is best when it has been quickly grown, and, therefore, it is advisable to select a rich piece of ground for it, and cultivate thoroughly.

Sorghum

Can still be sown largely for green fodder or for ensilage. It is also a crop which often pays well if grown for its seed. There is sometimes a ready sale for it at remunerative prices; and if the market is low the seed can be used for feeding to stock. It is very similar to shelled maize, but contains less protein and more fibre. It is best fed when ground and mixed with oats or peas. The question of utilising sorghum for the production of sugar is still receiving considerable attention in the United States. By careful selection the sugar content of some of the varieties has been raised from 9 to 14 per cent.

The season promises so well for summer crops that I would advise farmers to plant large quantities of sorghum and maize for ensilage. Nearly every year, at some time or other, I notice that the dairy farmers are short of feed for their cows, and this should be a good opportunity to grow bulky crops and store them up ready for these times of scarcity.

Broom Corn or Broom Millet.

The early crops should be carefully cultivated and thinned out. Thinning is very necessary, as on it depends to a great extent the even character of the broom. Sowings can still be made, the late crops often producing high-class brooms. Last year several complaints were received of the heads being smutted. This smut should be treated in the same way as the smut of oats or wheat—*i.e.*, by treating the seed either with hot water or blue-stone. Also, it is advisable to select only healthy plants for seed. It pays well to set aside a small portion of the crop, cull out the inferior and diseased plants, and allow the remainder to thoroughly ripen their seeds. By this means a superior class of broom can be obtained, the plants being more even and producing a more even class of broom.

Of late prices for broom millet have ruled very high, consignments bringing £28 per ton. It is, therefore, well worth while to try a late sowing, as a few acres put in now will very probably pay well. As a rule, the farmer contracts with the broom-maker to grow a certain number of acres at a fixed price, and this is, perhaps, about the most satisfactory way of doing business.

Millet.

Can still be sown for green fodder and for hay. There is a small sale for millet seed for feeding to birds, &c., the principal variety being White French. This variety grows well in many parts of the Colony, and it is a very heavy cropper, a few acres could often be profitably grown for seed.

Root Crops.

Land should be ploughed this month for turnips, potatoes, &c. It is a great advantage to have the land turned up early, and exposed for some few weeks before sowing. Turnips generally succeed well in this district, and even if the market is too low, they are always useful on the farm for feeding to all kinds of stock.

Rape, Kales, and Mustard.

Land should also be ploughed for these crops. In a fair season they will prove exceedingly valuable forage crops, and if fed off with sheep will often greatly improve the land. For quick-growing crops, Mustard and Dwarf Essex Rape are the best, and for late crop both Thousand-headed Kale and Jersey-tree Kale are valuable. The first sowings should be made next month.

Leguminous Crops.

If sown for green manuring should be ploughed under or fed off early this month, in order to prepare land for potatoes, turnips, &c. If fed off with pigs the land is left in splendid condition for these crops. Cow peas can still be sown for green fodder, ensilage, and for seed.

Wheat.

The season for wheat has been a good one, although for some parts of the coast it has been too moist, and the crops are badly affected with rust. The hay crop is an exceptionally heavy one, but unfortunately the hay-making season has been a bad one, the weather being very showery, and as a result a large quantity is of inferior quality, being damaged by the rain. On the College farm the early-maturing wheats did well. Allora Spring again appears to be about the best for grain; Steinwedel grew well, but was very rusty, and had to be cut for hay. Australian Talavera, White Lammas, and Blount's Lambrigg yielded splendid crops of hay, averaging about 2½ tons to the acre. Among the bearded wheats Medeah and Belatourka will yield the heaviest crops of grain. Canning Downs and French Bearded appear to be too weak in the straw, and the crops of these varieties were so beaten down by the heavy rains that they were almost valueless.

A Device for Fixing Codlin-moth Bandages.

Mr. Caleb Gambling, of Thornleigh, writes:—As the time is now upon us fruit-growers to bandage our trees as traps for the codlin moth, I thought it would do no harm to let you know of a way I, last season, adopted with success, in the way of saving time in fixing the bandages. When I began bandaging, I tied the bandage with itself, but found most of the caterpillars located in the knot, and sometimes, in untying, some got scattered, and were apt to be overlooked.

I next tied them on with a piece of string, but found, sometimes, that it was blown a short distance by the wind, and, when I wanted it, had to look, say, a minute ere I found it; and only a minute at a tree during the season means hours. Last season I bought some very light wire nails 1¾ inch long, and as fine as could be got; next got a piece of thin iron, and punched a hole very near the end; then screwed it in the vice; then, putting the nails in the hole, bent each one with the finger in the form of the letter S, and hooked one in the end of each bandage. It answered splendidly—no waste of time either in tying or untying; no reaching round the tree with a piece of string, and holding the bandage in position at the same time, but instant hitching or unhitching.

Orchard Notes.

W. J. ALLEN.

December.

Owing to the late severe frosts the stone-fruits in many of our cooler districts were greatly damaged, and as a consequence there will be a shortage in the supply from these districts, which means that the more fortunate growers who have not suffered in this way, and whose trees have survived the onslaughts of the aphis, which have been very active this season, will, in all probability, get good prices for all stone-fruits if well grown and attractively packed. Therefore fruit-growers should see that all soft fruits such as peaches, apricots, cherries, &c., receive their best attention. Nothing presents so bad an appearance as cases filled with all sorts and sizes of fruits, just as they may be taken from the tree, and the grower who is most careful in marketing will be well repaid for the little extra labour incurred by the better prices which his fruit will bring.

Wherever irrigation is carried on in the Colony, it will in all probability be found necessary to give the orchard a good application during this month. In running the water keep it confined to furrows, and on no account allow it to flood the land, which tends to pack the soil and does not benefit the trees as when properly confined to the furrows. Do not allow the furrows to become baked before the cultivation—in fact to bring the ground to a good tilth—two cultivations should follow immediately after each irrigation. In dry districts where cultivation alone has to be depended on to keep the trees growing, give at least one cultivation every four weeks during the hot weather, and should it rain get the cultivator to work immediately the ground is dry enough, in order to conserve as much moisture as possible, as in view of the present dry seasons, unless every precaution is observed, the trees will not be able to mature their fruit. See that all surface-drains are clean and in good working order, as heavy rains may be expected at any time now in some at least of our fruit-growing districts, therefore proper drains should be kept open to carry off any surplus water, and these drains should be so situated that they will carry off the greatest quantity of water with the least wash. There is nothing more discouraging than to see quantities of surface-soil washed off the orchard during a heavy thunderstorm, and the only means of minimising this danger is a proper system of surface-draining.

Keep a careful watch over all newly planted trees or refills, and see that they have extra water and work if they are not making the growth they should. Summer pruning, especially of the young apricot, may be done wherever the trees are making rapid growth.

As soon as the buds are in fit condition for using, summer budding of deciduous trees may be done, but I am not in favor of doing much of this work in summer, as, if the conditions are not of the most favourable (that is, stock young and vigorous, and planted in good soil, where, if necessary, water can be applied, and both tree and soil receiving best attention) the buds make only a weak growth by the fall, and in consequence will not turn out such a strong healthy tree as will a good dormant bud.

Attend regularly to the bandages on the apple and pear trees, once a week at least. In some districts where I have been I have noticed orchards where the bandages having been once applied, are practically then left to look after themselves, thus proving a splendid nesting place for the grubs, which pupate in the folds. For the last few years apples have been bringing very remunerative prices, and it will pay growers to try and save all they possibly can from the ravages of the codlin moth, and to pick up and destroy all fallen fruit.

In tropical parts of the Colony pineapples may be planted, if moist weather prevails. Suckers are the best to plant, being much the stronger, and the earliest to arrive at maturity. The pineapple seems to prefer a light and well drained soil, but will grow in a great variety of soils. Being a great feeder, a dressing of strong nitrogenous fertiliser will promote rapid growth and fine fruit. While the plants are young cultivation must be thorough, but not deep enough to cut the feeding roots, which are near the surface.

Bananas and other tropical fruits may also be planted during the rainy season.

An easy method of bottling peaches, apricots, pears, &c., is to wash the fruit, and, in the case of peaches or pears, to peel them; then place them, either whole or in halves, in the bottle in which they are to be kept, and pour over them a syrup made as follows:—Take 1 lb. of sugar (Brewer's crystals) to a quart of water, and allow this to dissolve, or boil for twenty minutes; then strain and allow it to become cold before pouring over the fruit. When the bottle is filled with the fruit and syrup the top may be placed on without the rubber, and the bottles placed in a copper in such a manner that they will not touch the sides of each other. For this purpose a light frame may be made, with round holes cut to fit the bottles, or hessian or old clean cloths may be placed in the bottom of the copper and between the bottles. Then add sufficient cold water, so that it will come within an inch and a half of the top of the bottle, and when this has been done the fire may be started and the water brought to a boil slowly, and allowed to boil for twenty minutes. The bottles are then lifted out, but be careful to keep them out of draughts, and remove the tops in order to fill to overflowing with boiling hot syrup, kept aside for the purpose, and as each bottle is filled put on the rubber and screw the top on tightly and set to one side until cooled, when the tops will generally be found to need tightening up again before the fruit is stored away in a dry cool place. As many fruits shrink in the cooking, it will be found necessary to take one bottle and from it fill up the others, and then overflow with the boiling syrup. Fruit canned in this

Practical Vegetable and Flower Growing.

W. S. CAMPBELL.

Directions for the Month of December.

Vegetables.

The season, up to the time of writing—November 16th—has generally been so good for the growth of vegetables that we may now reasonably expect a continuation of it instead of the usual trying weather of December. Vegetables should be plentiful and good over a large area of the Colony; but, unfortunately, I only too frequently observe, when travelling in various places about the farming districts, that there are either no vegetables at all on the farms, or else very frequently when vegetables are grown in a good season such as this, they become lost to sight—such as they are—amongst the luxuriant weeds. Some few farmers, I am pleased to say, do take the trouble to keep their families well supplied, but these same exemplary men take the trouble also to provide other good things for their families, who live well, and far better, if they please, than we can in the city at a trifling expense. They grow their flour, their meat, and such meat that we cannot obtain at even 8d. per pound; their milk, butter, and cream, vegetables, fruits in abundance; their hams, bacon, and pork all at a minimum of expense and trouble. There are seasons in certain districts where it is almost an impossibility to produce vegetables unless a good water supply is available, but good seasons come again and advantage should be taken of them.

Beans (Kidney and French).—Efforts should be made to grow one or more varieties of this useful vegetable, and to keep up a supply whenever it is possible. Remove all plants which have ceased to be productive and make use of the land upon which they were growing for something else.

Broccoli.—Sow a little seed in a seed-bed or box, where it can be watered and shaded when necessary. When the seedlings come up and are strong enough to transplant, prepare a small portion of ground by manuring and digging well, and then prick out the broccoli plants about 3 or 4 inches apart. Here they will soon grow into strong little plants in good condition for planting in a large bed, where they are to grow. This bed should be made very rich with abundance of farm-yard manure.

Borecole or Kale.—Sow a little seed, and take care to protect the seed-bed from the hot sun, and do not allow the seeds to become dry after they have once been watered.

Cabbage.—A little seed may be sown, and any good, strong seedlings which may be available should be planted out, unless in places which are still suffering from drought, for the cabbage will not grow well without a good deal of moisture.

Cauliflower.—Sow a little seed, and manage as advised for brocoli; for cauliflower and brocoli are pretty much the same thing as regards practical purposes.

Cucumber.—A few plants may be raised if required, but the chances are that a sufficiency of this vegetable has already been grown.

Celery.—Sow a pinch or two of seed occasionally, just to have on hand a few plants should they be required. Strong, young plants may be set out in trenches. These trenches need only be made a few inches deep, but the ground should be heavily manured, and abundance of water should be available for use during the growth of the plants. Earth up a few nearly full-grown plants to blanch their stems.

Cress and Mustard need a good deal of moisture and abundance of well-rotted manure. Sow a little seed should a supply of this vegetable be required.

Egg Plant.—Sow seed or plant out any seedlings available.

Maize Sugar.—Sow a little seed in the warm coastal districts to keep up a supply. Be certain to obtain the proper variety of maize, for that in general cultivation is of but little use as a vegetable.

Onion.—A little seed may be sown where the soil is moist and the season is good, for it will not grow in dry places, unless water can be supplied.

Peas.—Sow a little seed in the coolest parts of the Colony.

Pumpkin.—It is not probable that any more plants will be required, but if so, a little seed may be sown with every chance of success in the warm moist districts.

Parsley.—A little seed may be sown if plants are required.

Radish.—Keep up a supply of tender young plants by sowing seed from time to time. A few short rows at a time will be sufficient. Use plenty of rotten manure, and, if necessary, liquid manure occasionally, in order to grow the radishes as quickly and as tender as possible.

Spinach.—Sow a little seed during the month.

Tomato.—It is hardly likely that more plants will be required, for every one with a vegetable garden should have abundance for all needs. Keep the plants free from all rotten and decaying fruit, and, in particular, all those which show signs of black spot. These should be destroyed by fire, to prevent spread of the fungus which causes it.

Turnip.—Sow a little seed in drills.

Flowers.

So far, this season, flowers of many kinds have been extremely plentiful generally, and it seems probable that, during December, they will continue to be abundant. A few occasional showers work magic in the flower-garden, particularly in such a mild season as the present.

Most attention will now be given to the chrysanthemums—that is, by those growers who desire to grow flowers of great size. Plants which are grown for this purpose should have only one stem, and to do this all suckers which grow round about must be kept down by constant removal. Should the weather prove to be dry the plants should be supplied with water and occasionally with weak liquid manure.

Dahlias should now be growing satisfactorily. They should only be allowed one stem each, and then their growth should be regulated by pinching the shoots or removing some. Provide each dahlia with a strong stake as a support, and tie up to this as it increases in size. The plants become very top-heavy, and being brittle are very liable to be broken down by strong winds unless they are tied up to supports.

Gather seeds of any plants it may be desired to save in good time, or they may be lost.

The Cultivation of Mushrooms.

From the numerous inquiries made lately about mushrooms and their cultivation, it is apparent that so great interest has been aroused with respect to this delicious vegetable that a few remarks about it may be useful to those who desire to grow at least a sufficiency for home use.

At certain times mushrooms may be seen in thousands in grass paddocks in various parts of the Colony, and, although so plentiful, quantities are allowed to go to waste, although they may be had by surrounding inhabitants simply for the trouble of gathering them. About the cities and towns, however, they are more appreciated.

In some places about Sydney, when the soil is in the proper condition—sufficiently warm and moist—mushrooms are very abundant. I generally walk across Rushcutters' Bay recreation reserve twice a day, where the reclaimed land has enormous dressings of stable manure occasionally, and where many horses are allowed to graze. Here the mushrooms abound in thousands sometimes, and here come young boys and old boys, young girls and old girls—very old some of them—with bags and baskets, and hats and handkerchiefs, in the early mornings, scratching about, like chickens, with sticks and old knives amongst the long grass. Many collect a good breakfast of mushrooms of all sizes, from that of a marble upwards, and mushrooms seem to be highly appreciated by these poor fossickers.

There is little or no difficulty and no mystery whatever about cultivating this delicate, wholesome vegetable. Some seem to think it must be grown in caves and places underground, whereas in point of fact it can be grown in the open air, although not so well as under some protection from winds and sun. The reason for this is that the material in which mushrooms must be grown artificially should be kept in a certain condition of moisture and as near as possible at a regular temperature. Anyone who has carried on any kind of gardening knows full well that our drying winds and warm sun would make this well nigh impossible, under ordinary circumstances, in most places in this Colony.

First of all, the proper material must be obtained, and this should be nothing else than good horse-dung. Take note that cow-dung will not answer the purpose. Make up your mind about this at once, and don't trouble about making a trial, or else you will simply waste time; for although the mushrooms may grow in it, the chances are they will not succeed to the extent that would justify its use.

Get good horse-dung with short straw that has been well used in the stable, and has been well saturated with horse-urine. When this has been obtained (say, a cart-load, or less if required, although I may point out that I have always found that it is far easier to ferment a considerable quantity than a small quantity; I should, therefore, advise at least a cart-load; for if you do not require the whole of it for a mushroom-bed you will find the balance only too useful in even a small garden) spread it out with a fork in a sheltered place, and build it up into a square heap. As you build, shake it out nicely, making the heap compact, but not so compact as to prevent access of a certain amount of air. If the dung should be dry, moisten it a little with water, but be careful not to make it wet. This heap will become very hot, when you must turn it over forkful by forkful, and shake out as before, and on no account allow it to become burnt or fire-fanged, as the general term is, for if you do so the manure will be ruined. This may be prevented by a little water, so as to keep it moist. The heap may need to be turned once more after a day or two, and when it has cooled down to a temperature of about 85° F. it may be used for the purpose of a mushroom-bed, which may be made in a shed, stable, or out-house, to the inside of which drying winds have not access, or, at any rate, to such an extent as will dry up the heap of manure. The bed can be made of any size or of any shape—level or sloping—just as you please, but the mushrooms will grow just as well on a level bed as one made any other way. The object of building up a slope is to have a larger surface area on the same ground space than a level bed would give. The bed may be made in a box or a shelf, or anywhere you like, provided the material does not become too dry or too cold. Having selected a spot, build up your fermented dung and short straw—of course, the dung and straw has been well mixed together each time of turning the heap—to a depth of at least 2 feet, and make your bed as broad or narrow as conveniences require. Hammer or beat it down as you make it up, and make it up as neatly and as even as ever you can, and then let it remain for a day or two. It will, in all probability, get hot again, but the heat will gradually diminish. Try the temperature with a thermometer, and when the temperature has fallen to 80° or 75° F., it is ready for use, and as the mushrooms will not come up of themselves, you must obtain mushroom spawn. This can be purchased from seedsmen in Sydney, who sell it in the form of cakes or bricks, at the price of about 6d. a brick. Break up this spawn into pieces about the size of your thumb, or even a little smaller, and stick this into the mushroom-bed, about 4 inches apart, a little below the surface. In about a week or so the mushroom spawn will start into growth, and gradually fill the bed with mycelium, a net-work of white root-like threads. When you notice these threads

beginning to grow, cover the mushroom-bed all over with good friable loam to the depth of about 1 inch, or at most 2 inches; make this firm, but do not hammer it down too hard. Before putting on the soil, it is a good plan to spread some straw over the bed until the white threads grow, then take it away and spread the soil, and afterwards spread a light layer of straw over the whole bed. Should the mushroom-bed appear to be getting dry, sprinkle it with water of the same temperature as the atmosphere, but on no account make the bed wet; it must be moist, but not wet. This is very important, and on this may depend success or failure. In the course of a month, or a week or two longer, little knobs will form on the mycelium, and very soon these little knobs will suddenly develop into mushrooms. After that there should be mushrooms in abundance, of the very highest perfection. Like everything else, mushroom-growing needs some practice, and the chances are the first attempt will be a "mess-up," but do not give up, try again, and endeavour to find out the cause of failure, and afterwards, when you are successful after a little experience, you will be surprised that you ever failed. When gathering the mushrooms take away the whole of the stalk and root of each mushroom, for if you do not the bed will speedily diminish in its productiveness. This is of very great importance, and should on no account be overlooked.

It is one thing to grow mushrooms, but quite another to cook them well, and on this depends a great deal, for a well-cooked mushroom differs pretty nearly as much as cheese from chalk. Perhaps by the time the mushrooms are available the Editor might rummage up something super-excellent in the way of recipes for cooking mushrooms.

Spraying Pigs.

There is probably no animal, not even excepting the earnest dog, which suffers more discomfort from vermin than a neglected pig. When they can get a chance to wallow in mud pigs manage to get rid of some of their unwelcome guests, but it is necessary to assist them a little. Spraying with a sort of mild kerosene emulsion is the method now recommended by the faculty. Two or three itchy pigs are put into a small pen and the kerosene, well diluted with hot water and thoroughly emulsified, is sprayed on them with the full force of an ordinary fruit-tree pump. The crevices and corners of the styes also get a liberal dressing of kerosene, and the result is a contented pig with nothing to detract his attention from the solemn duty of amassing pork.

General Notes.

Forestry.

To anyone who cares to let his thoughts run ahead for a decade or two the prospects of the timber resources of this Colony would look pretty blue.

Of course, the State will always be able to keep, as occasion demands, a restraining hand upon the devastation of areas especially set aside as forest reserves, but it is among those in occupation of the land, who consider it their first and very often their sole duty to destroy every scrap of timber on their holding, that some effort is necessary to inculcate a sense of the harm they are doing. Go where one will throughout the length and breadth of the once timber-clad districts of New South Wales, and the country will be found denuded for miles and miles. Indeed, it is not at all improbable that some day or other our grandchildren will have to fall back, like Mr. McIntyre's friend, upon an iron bedstead for firewood. It is not asserted that the destruction of these enormous tracts of timber affect the rainfall; but it is pretty certain that as the country which Nature has seen fit to clothe in dense arboreal raiment is stripped bare and not even shelter-belts are left, the face of it will become changed—always for the worse—and the difficulties of the husbandman will be increased a hundredfold. All this, apart from the fact that a few acres of the original forest on a homestead constitute a source of wealth that asks for nothing beyond mere standing room in a holding, which is, as a rule, already so large that the owner can scarce find time to cultivate and attend to more than a little patch of it.

An American farmer, evidently brought up in a school which regarded a growing tree as a menace to progress, has been asking for some information about tree-culture, and how it might be made the means of providing a nest-egg for his declining years, and the answer given in *Meehan's Monthly*, by Mrs. W. Seliger, is worth earnest consideration by the landholders of this Colony.

Mrs. Seliger says: "The art of American forestry, as practised, consists simply in annihilating radically all woodlands, without renewal of corresponding areas. What is left to chance to grow up again as sproutland is without systematic effort or order. That the coming generations will severely suffer and the whole country be exposed to the fury of the uncontrollable elements when the protecting forests fail, seems to be no concern of the individual. To create forests demands centuries of time; to use judiciously the existing ones common sense and reason are great factors for their protection, if applied. With no forest schools, no practical instruction in forest management at our colleges and universities, the art of forestry will yet

remain, for a long time, an unknown but eminently necessary duty for every person interested in the welfare of this country. Japan has long ago—twenty years at least—sent youths to Germany for the practical study of forestry, as it is there taught in all its branches. There the forests lands are systematically regulated and always made a source of revenue, without diminishing the area or the product of it. We do not here (in America) understand the national use of forest lands; neither does the farmer realise that the poorest land, if utilised for forest growth, will surely bring good returns in the course of time. In Germany some of the forests in existence to-day witnessed the rites of the Druids centuries ago. The smallest hamlet has a forest for use of the people, under regulations which protect its existence." Mrs. Seliger goes on to say: "It may perhaps interest your readers to know how forestry is controlled, and to hear of a certain example with which I am perfectly acquainted, it being my native place. Parchin, in Mecklenburg-Schwerin, has about 10,000 inhabitants and a land area of about 2,396,000 rods of the city proper, and fields, gardens, meadows, moors, &c. There is also a forest area of 1,290,000 rods. It also owns fourteen villages, which all have their separate forests besides their lands, combining a village area of 2,365,581 square rods. The income of the city is (in a round sum) £10,000. The cost of the city is about £8,500. Following are a few items :—

			£
Income from	rent of lands	... ...	800
,,	,, meadows and gardens	... ...	850
,,	,, hunting permits	... ...	100
,,	,, forestry	... ...	2,000
,,	,, villages	... ...	2,700
,,	,, sheep pasture	... ...	125
,,	,, city taxes, &c.	... ...	600

Two senators, one of them a lawyer or a jurist, the other a practical engineer or surveyor, direct all work in field and forests. The City Council is of thirty-six members (term of office, six years), six of whom serve in the Forest Department. These councillors personally supervise all work done in the forests, and mark and select trees to be cut. They also attend to the planting-out and reseeding for new forest growth, and attend to thinning and other operations necessary to ensure the production of good timber."

Fig Trees which do not Ripen their Fruit.

About the most exasperating thing it is possible to have in a garden is a fig-tree that bears enormous crops of fruit which never gets beyond the size of a marble before it withers and drops off. Some authorities advise severe pruning; but the operation has no more effect than hacking through all the roots in a semicircle about the tree. Then perhaps the planting of more fig-trees in the vicinity to make up a family party is tried; but without avail. The Smyrna fig—the one used in the Mediterranean for drying—is the greatest offender in this

respect. In California, while other varieties of figs mature with germless seeds, the habit of the true Smyrna to drop the immature fruit because the blossoms have not been pollinated, is most pronounced. At Fresno, according to a report in the *Californian Fruit-grower*, there is a 60-acre orchard of Smyrna fig-trees, which have never borne a ripe crop. Every year the trees make thrifty growth and set a full crop of figs, which, lacking fertilization, wither and drop off when they attain the size of a hazel nut. Mr. Roeding has been experimenting with the Blastophaga, or Fig Wasp, for some time, with indefinite results, but has now secured the co-operation of the Department of Agriculture at Washington in carrying out a series of investigations that, it is expected, will ensure successful production of the true Smyrna fig in California. In a letter to the *Fruit-grower*, Mr. Roeding says:—"Five Capri figs containing galls have come to maturity, and the blastophagæ, or fig wasps, are now emerging from the fruit. Upon examination of the figs this morning, I found upon several fig wasps crawling on the outside, and saw one escape through the orifice at the blossom end. A number of young figs are growing on the same trees, so that I entertain no doubt but that these insects will perpetuate their species. Everything points to the permanent introduction of the blastophaga in this locality. By January next I am confident that these experiments will be definitely determined. Sufficient progress has been made to warrant the statement that the successful introduction of the blastophaga hinges on protecting the figs containing these insects during the winter months. I have several of the wild, or Capri, fig-trees growing, and shall build a house, largely of glass, over one of these trees, and in this way protect the tree and figs from possible injury by frost. A few edible figs have been fully developed on my Smyrna trees, the flowers having been pollinated by the blastophaga. In my orchard proper, none of the Smyrnas were fertilized because I hung all the Capri figs containing fig wasps in my wild fig-trees with the idea of perpetuating the insect rather than producing figs in my Smyrna orchard this year. If I am successful in wintering several hundred of the Capri figs on my wild fig-trees, I should have no difficulty in producing a full crop of figs in my 60-acre Smyrna fig orchard next year."

Caprification has been regarded by the fig-growers in the Levant and Central Italy, for all time, as a necessary process. It consists in hanging fruits from the wild, or Capri, figs in or near the cultivated trees, in order that the fig insect, *Blastophaga psenes*, Linn., which infests the wild fig, may carry pollen from one to the other, and thereby effect fertilisation. Quite a number of prominent scientists have investigated and written about the process; and while some have maintained that the operation is an old-fashioned fad, neither necessary nor effective, others have advocated the introduction of Capri trees and systematic experimentation. In 1892, at the Congress of the Australasian Association for the Advancement of Science, held at Hobart, the following resolution was passed:—"A Committee, of which Baron von Müeller was Chairman, has been sitting for the last two years to inquire into the advantage or otherwise of introducing

into Australia the insect which fertilises the cultivated fig in Southern Europe and Asia Minor. The result of this inquiry is that this insect-fertilisation increases the yield of the trees, and, perhaps, also improves the quality of the fruit; and the Council of this Association, therefore, recommends that steps be taken to introduce the caprification fig and fig-insect from Smyrna."

In commenting upon this resolution, in the *Agricultural Gazette* for June, 1892, the late Mr. A. Sidney Olliff mentioned that we already had growing in certain localities of New South Wales both the Smyrna and the Capri figs, and in his opinion it would be better to import, as had been done in California in August, 1890, some of the blastophagæ.

Mr. Olliff also drew attention to the presence of a fig-insect, *Pleistodontes imperialis*, Saund., which is found very abundantly in our native Moreton Bay fig (*F. macrophylla*), and which, it had been suggested, might answer the same purpose as the European *Blastophaga*. At Wagga Wagga orchard there are a number of true Smyrna fig-trees, and also some of the Capri variety. The trees are not yet sufficiently advanced to enable anything definite to be said about them; but by next season, in all probability, it will be possible to see whether the Smyrnas are in need of this assistance.

Relation between Cutting-time and Feeding-value of Lucerne.

The Director of the Agricultural Experiment Station, Utah, U.S.A., has been conducting, during the past five years, a series of investigations to determine at what time in its growth lucerne should be cut for the best results as regards yield per acre and feeding-value.

For the experiment a paddock of lucerne, or Alfalfa, as it is called in the States, was divided into three strips. No. 1 was cut regularly when the first blooms appeared; No. 2, when in full bloom; and No. 3, when half the blossoms had fallen, the cuttings being denominated "early," "medium," and "late" respectively. Comparisons were made of the first, second, and third cuttings, and all were tested in conjunction with other fodders like corn, red clover, &c. Following are the conclusions:—

1. The largest annual yield of hay per acre is obtained by the method of early cutting, and the lowest by the late, the average result standing as follows:—Early cutting, 100; medium, 92; and late, 85.

2. The early cut crop contains the highest per cent. of protein and fat, the most valuable food constituents, and the lowest per cent. of crude fibre—the most indigestible portion. The former decrease constantly, while the latter increases rapidly from early bloom to the full maturity of the plant.

3. The proportionate amount of leaves to stems is greater at early bloom than at any subsequent time, and both leaves and stems contain a greater per cent. of protein and a less per cent. of crude fibre at this time than at any later period in the growth of the plant. The relative proportion of leaves to stems in the different cuttings is as follows:—Early, 42 to 58; medium, 40 to 60; late, 33 to 67.

4. Lucerne leaves, as compared with stems, are very much richer in protein, fat and nitrogen free extract, and they contain a much smaller proportion of crude fibre. The per cent. of the protein and fat grows constantly less, and that of the crude fibre greater

from the time of early bloom to maturity. The average composition of all cuttings and crops shows the leaves to contain 150 per cent. more protein than the stems, 300 per cent. more fat, 35 per cent. more oxygen free extract, and 256 per cent. less crude fibre.

5. The more important nutrients—protein and fat—have the highest per cent. of digestibility in the early cuttings, and it grows less and less with the age of the plant.

6. In the feeding-tests the highest gains were made from the early cuttings, and the lowest from the late, the results standing as follows :—Early cutting, 100 ; medium, 85 ; and late, 75.

7. The variation in the amount of the different cuttings eaten per day was very slight, being the highest for the early cutting and the lowest for the late ; but the quantity of dry matter, and also of digestible matter, required for a pound of gain was decidedly lowest for the early cutting and highest for the late, the relative amounts of dry matter standing as follows :—Early cutting, 100 ; medium, 131 ; and late, 166.

8. The annual beef product per acre was largest from the early cuttings, not only in the general average, but in each separate season's test, and that from the late cuttings was smallest, the proportional products standing as follows:—Early cutting, 100; medium, 79½ ; and late, 69½.

9. Taking all points of comparison into consideration, both separately and collectively, including everything that pertains to the largest yield and highest feeding-value, the tests favour cutting lucerne for cattle-feeding when the first blooms appear.

This conclusion, it is satisfactory to state, confirms the advice given by the experts of this Department, and by Mr. Geo. Bishop of the Hunter River district, whose article on lucerne-growing appeared in the *Agricultural Gazette*, p. 634, June, 1898.

Crop Comparison.

10. The first crop gave the largest yield in each of the five tests and in fourteen out of the fifteen cuttings, while the third crop gave the lowest for every test and in every cutting but one. The average acre yields for the five years, including all cuttings, stand in the following relation :—First crop, 100 ; second, 78 ; and third, 39 ; for the early cuttings alone—first crop, 100 ; second, 85 ; and third, 66.

11. In the average composition of all cuttings for three years the nutrients of the three crops vary but little. The second has slightly the highest per cent. of protein and fibre, and the third the most fat and nitrogen free extract.

12. The third crop has the largest proportion of leaves to stems ; but the per cent. of protein in the leaves is highest in the second crop, and next highest in the first. The leaves of the first crop contain the most fat, and of the second the least.

13. The third crop produced a higher average rate of gain in the feeding-tests than the first or second, and also higher than any of the separate cuttings. The amount eaten daily was also highest of all ; but the dry matter and digestible matter for a pound of gain were the lowest. In a pound per pound comparison the gains stand as follows :—First crop, 100 ; second, 81 ; third, 126 ; dry matter for a pound of grain—first crop, 100 ; second, 115 ; and third, 69.

14. The beef product per acre, taking the average result of all cuttings for the five years, was very much the highest for the first crop, and decidedly the lowest for the third, standing as follows :—First crop, 100 ; second, 61 ; and third, 45 ; but taking the early cuttings alone, they stand—first crop, 100 ; second, 80 ; and third, 69.

15. Pound per pound, taken as a whole, the results show the highest feeding-value for the third crop and the lowest for the second.

16. The average annual beef product from early-cut lucerne was 705·61 lb. per acre. It required 9,575 lb. of timothy to produce an equal weight, 11,967 lb. of red clover, and 10,083 lb. of shredded corn-fodder.

Weeds and Cultivation.

It seems incredible that there are still to be found in the ranks of agriculturists quite a number who make no effort to destroy spring weeds until the summer is quite advanced. Then, when perhaps half of the pests have gone to seed, a sudden onslaught is made, and the weeds are either torn out with cultivators that have been lying idle a

year or so, and left on the surface in ragged heaps, or scratched up into the headlands. This method is bad enough, but is, perhaps, not quite so bad as the ploughing under of tall rank weeds right on the top of a dry summer, when every particle of moisture in the soil is urgently needed by the crop. Some of those who practice this system will tell you that the weeds will rot in the soil, and form humus, and do all sorts of good. No doubt they will in the course of time, but throughout the dry season they will be in the soil in an excellent state of preservation, keeping it rough and open, so that the crops are, so far as present requirements of moisture are concerned, even worse off than if the weeds were all standing in full bloom. If any one has any doubt about this, it is easy enough to test it. Take, say, an acre of orchard or cropped land. Divide it into four equal strips. Let the weeds do as they jolly well please in No. 1; plough them under, say, in December, in No. 2; scratch them out with a cultivator of some kind when they are pretty well advanced in No. 3; and run a cultivator with sweeps provided for the purpose over the fourth strip every time, from about the end of August up till Christmas, a weed shows its head. One season will be ample to demonstrate to even the most bigoted adherent of the old theory that weeds "shade the soil," that the few odd hours spent in occasionally cultivating No. 4 strip were about the most profitable ones of the year.

When the summer fruit is picked, and the spring crops are harvested, the land can have a spell, and if during that time a few weeds do grow, they can be turned in during the early winter ploughing, and will do good, because under the moister conditions of winter and deeper ploughing, they will have by springtime become quite rotted, and converted into useful material. But it is a point well worthy of determination whether it is not really more profitable, in orchards at all events, to scratch in lightly as soon as the crop is harvested, a liberal seeding of something to produce a crop that may be turned under in winter for green manure. For orchards in the Cumberland district, rape seems to be about as good as anything. The seed is cheap, a few pounds cover a lot of ground, it hardly needs covering, and grows rapidly, and, in the ordinary run of orchard soils, not too luxuriantly on top. It may be asked if it is not an advantage to have for green manuring a crop that produces abundance of tops? Well, no doubt, it is; but it must be remembered that in orchards, as a rule, there is not always available a plough which will turn under quite effectively the long straggling growth of cow-peas. Rape, or even oats or barley, about a foot high can be turned under with any little orchard plough, and its effect upon the mechanical condition of the roughest and most unkindly of orchard soils is marvellous. Generally speaking, land should be ploughed deeply in late autumn and left as rough as possible throughout the winter. With the approach of spring the soil should be harrowed down, and, if the experience of the last few seasons is anything to go by, it is as well, in this preliminary loosening of the soil, to run the implements across the slopes. Otherwise, torrential rains will wash the hillsides severely. As soon as spring is fairly in, the cultivators should be kept going between the

trees and between the rows of crops at least once every three weeks or month in ordinary weather, and after every heavy downpour in a season like the one we are now enjoying. In causing, by means of constant stirring, a layer of finely-pulverised soil to act as a mulch, we also absolutely prevent weeds from getting roothold. For sorrel, summer grass, and even for nut-grass, constant cultivation is the cheapest and most effective remedy.

Pulverising the Soil.

The value of pulverising the soil repeatedly is not generally understood by farmers who cultivate large areas of land, but the market gardener, who has only a small space on which to make a living, shows by his methods that he realises the importance of this work. Incidentally, pulverising the soil means good culture of plants, but plants can be cultivated and the soil may not be pulverised. The finer we pulverise the soil around plants the better is the mechanical condition of the soil for making the plants grow and resisting dry weather. When we study the subject from a scientific point of view, we can understand better the effects of what is good culture. Everybody in this age understands the theory of the evaporation of water from the soil; how the water rises from the subsoil or underground springs by capillary attraction, and, if not taken up by the plants, passes off into the air. This evaporation begins on the surface, and extends gradually downward. If the soil is too thick and compact the moisture has difficulty in drying up, and the top layers dry very slowly. Such land is usually wet and muddy in ordinary rainy weather, and it is unfit for crops. In order to facilitate capillary attraction, the soil must be so pulverised that the air spaces in the soil are small. This enables the soil to rise gradually and continuously. By good cultivation on the surface the plants are kept well supplied with moisture all of the time, and every fresh stirring of the top soil starts up new reservoirs of water from the subsoil.

Gardeners have what they call a dust mulch, which is simply another name for good, thorough surface cultivation. They stir the soil around the plants every week or few days, and the soil becomes so thoroughly pulverised that capillary attraction is in rapid progress all the time. It has been demonstrated that, on the right kind of soil, garden plants can in this way be brought through the driest weather imaginable, and without a drop of water artificially supplied. The dust mulch is better for the plants than an artificial one of leaves and litter, although the latter are not to be neglected where it is impossible to give the thorough pulverisation required. This stirring of the surface soil is more important when the plants are young than when they get half grown. Then they shade the ground around the roots, and form a protective moisture holder that helps them through the hot weather. After all, it is the young immature plants that we have to care for and tend, and, if we succeed in getting them started aright, the crops are pretty well assured.—A. B. Barrett, Minnesota.

Nerves and Milk Production.

It is the nervous cow, writes Mr. C. W. Jones, of New York, that gives the greatest amount of good milk. One inclined to go to fat makes an excellent beef cow, but a relatively poor milker. As the nervous cow is apt to be smaller in proportion than a large, fat, beef-making cow, the idea gains some headway that she requires less food. Indeed, there is a tendency, in some quarters, to reason that a cow needs food in proportion to her size—that is, a large cow requires more than a small one. This is an error of a most pronounced order. It is nervous energy that absorbs and uses up food, and it requires more to feed such a nature than it does one of a phlegmatic disposition. If anything, the opposite to what is true in general practice should be observed. More rich and highly concentrated food should be given to the small milker than to the large beef-maker. The good milker, if her digestion is good, can change more of her food into milk than another animal can convert into beef or fat. A good deal of this food that is given to the milker is converted directly into milk, and is thus more profitable than when fed to the beef cattle.

The nervous animal's mechanism is more easily deranged than that of the heavy beef-making animals. A plough-horse can stand more abuse than the high-strung race-horse. Many dairymen do not appreciate this thoroughly, either in their feeding or caring for good milch cows. As the whole value of the animal's products depends very closely upon the condition of her digestion, a study should be made constantly of the cow's health. In a normal condition she can take a great amount of food, and convert it directly into milk. This food should be given with the best possible caution, so that it will not injure the health of the animal. Give all to the cow that she will eat up clean, is a good rule to go by, but if her appetite declines there is something wrong with her digestion that needs instant attention. Very frequently this cause is so simple that one overlooks it. In a nervous cow, a sudden fright, undue excitement, or running in the field, or anything that will upset the nerves, may cause the flow of milk to stop temporarily, and upset the digestion, so that the full quantity of milk will not be given for weeks. It is to guard against such slight accidents that the dairyman must exercise his supervision and authority. His cows are high-strung milking-machines that will easily give out under abuse or misuse.

Harvesting in California.

In comparing the system of harvesting the hay and grain crops of California with the methods usually followed in the colonies, the questions of soil and climate have to be taken into account; but, speaking generally, the conditions in both countries are so much alike that an interesting study and comparison can be made, and the Californian system in part may be found to be specially adapted to the requirements of Colonial farmers.

According to the late Mr. James Martin, M.P., who spent a considerable time touring the United States investigating cultural

operations and machinery, and who, of course, was able to speak with the authority of an expert of the highest standing, the mowing machines used in California do not differ materially from those with which our farmers are familiar, but the tendency is in favour of extra width of cut, and a mower with a 7-foot cutter bar is considered an ordinary machine, whilst the Australian farmer is generally satisfied with a 4-foot 6-inch or, at the outside, 5-foot cut.

Oats and Alfalfa, that is, our lucerne, are the two staple hay crops; and as the Californian farmer can do first-class work with two horses cutting a 7-foot swath, there is no good reason why more of our farmers should not advance from their present 4-foot 6-inch and 5-foot machines to the 6 and 7-foot cuts as used in that State.

In most of the central and southern parts of California the reaper and binder for grain harvesting is not now so popular as formerly, for the reason that straw is of little value, and the width of cut being proportionately narrow, the time required to reap, bind, and thrash a large crop is so much greater than with the header and combined harvester that the go-ahead Californian, who will have his work done in a wholesale manner, insists on cutting a swath at least from 14 feet to 18 feet wide, whereas the binder will only cut about 7 feet.

Until recently the header was the popular machine on the Pacific Coast, and there are still a very large number in regular use, many farmers preferring them to the more recent combined harvester.

The header is not unknown to Australian farmers, as several attempts have been made to introduce them in the colonies, but so far without success.

It is the simplest form of reaping machine, the width of cut varying from 12 feet to 40 feet.

The fingers, cutter-bar, and knives are of the usual pattern; the reel is of the same width as the cutter-bar, and can be raised or lowered to suit the height or condition of the crop.

Instead of drawing the machine, the horses push it from behind the cutter-bar, the number of horses varying according to the width of cut. The machine is set so that an average length of only 6 inches of straw is reaped with the ear, and as the cut crop falls on the revolving platform apron, it is carried to the elevator canvasses, which in turn carry it up and deliver it into a waggon, the waggon being driven alongside the machine in such position that it receives the cut crop from the elevator. The cut grain is then hauled to where the thrasher is to work, or as sometimes happens, where it is at work, and the thrashing is done so rapidly that records up to 2,500 bushels per day have been made.

It will thus be seen that the process of harvesting with the header is of the very simplest character, and the machines are now made of excellent design, of great strength, and with all necessary adjustments within the reach and control of the driver, so the ordinary unskilled farm labourer can work them successfully.

To those who have never seen a header, the simplest description that can be given of it is to say it is like an immense reaper and binder with the binder left off, and the wheels so high as to leave a 3-foot stubble if necessary.

The first cost of a header of good make with 14-foot cutter-bar is $375, that is equal to £78 2s. 6d. English money, and the cost of repairs per season is very small.

Now we come to the strictly Californian machine—that is, the combined harvester, or, to be more precise, the header and thrasher combined.

In developing this machine, the farmers and manufacturers of California are deserving of all praise, as the idea originated and has been entirely worked out and perfected by the progressive men of the Pacific slope. Nowhere else in the United States has the combined harvester been taken to kindly (up to quite recently, at all events), but its merits are such that it must find its way into the large wheat-growing areas of that country.

So far as cutting and elevating, that work is done on the combined harvester the same as on the header, with this important difference—that the horses pull in front of the combined harvester instead of pushing behind, as with the header.

On the grain leaving the elevator it passes into the drum or cylinder, which is always fitted with spikes, the Americans preferring the spikes to the beaters which are used on English thrashers. As there is so little straw with the head or ear, the drum or cylinder can thrash a very much larger quantity than is possible with the long-strawed Australian crop as fed to the thrashers in use here; and it is this shortness of the Californian straw which enables a 30-inch drum to thoroughly thrash all a 16-foot cut machine can harvest.

After the crop has been thrashed, the grain passes over shakers and screens of the usual pattern, the straw, as a rule, being discharged on to the stubble or, in some cases, delivered into a waggon which is driven alongside the machine.

The grain when cleaned passes through shoots into bags, and men are stationed alongside the bags to sew or tie them up and deliver them in the field, the machine keeping on working all the time. These bags hold about 2 bushels. Although there is a difference of opinion as to whether this size is better than our larger wheat bag, there can be no doubt that it is a more convenient size for handling.

The width of cut of the combined harvester varies from 12 feet to 20 feet, the size most in favour being 16 to 18 feet.

The price at the factory, within about 60 miles of San Francisco, was, according to last quotations, something over £300.

This machine, the combined harvester, is built almost entirely of wood, the road wheels and gearing, of course, being iron or steel.

It is necessarily a somewhat complicated machine, as it does the whole of the work of harvesting at one operation, and does it whilst moving in the field.

Objection can be taken to it on the ground that the smallest breakage stops the work of eight men and twenty horses, this being the average number required to attend and work a combined harvester; but each year's experience renders breakages less likely to happen, and as there is always an expert in charge of the machine with a supply of extras at hand, the loss of time in repairing breakages or wears is not found to amount to very much.

From carefully collected data it is fair to assume that the average cost of harvesting per acre with this combined machine is a mere trifle, and the grain, as delivered into the bags, is considered to be well cleaned and fit for market. But the Californian grain, as delivered to the local miller, would certainly not satisfy an Australian buyer, no attempt, so far as reports go, being made to grade it, as is done with the revolving screens of the English thrasher, besides which there is a larger percentage of dirt and trash in their wheat than is usual in Australia. The argument used is that the field is the place to thrash the wheat, and the mill the place to thoroughly clean it, and there is a great deal in the contention, as the enormous quantities that have to be dealt with make it necessary that the grain be thrashed with the utmost speed, and the final cleaning given to it in the mill.

But in considering the question of Californian harvesting machines and the system of harvesting most popular there, careful note must be taken of one important factor—that is, the wheat will remain standing, when fully ripe, without injury for weeks, the only trouble to be feared is a violent storm, which sometimes beats down the standing crop and causes loss.

This is a condition unknown in Australia, as our wheat, when ripe, must be harvested quickly or it sheds and wastes.

As much has been said and written of the immense areas that are under crop in California, and many Australian farmers have wondered how it was possible to deal with such large areas when the wheat "came in" all at once, this explanation of the accommodating nature of the crop in waiting without shedding for the machine to come round will have a special interest for them, and explain what has previously been to some extent a puzzle. But, whilst perfecting the header and combined harvester, the makers of these machines kept in view the desirability of replacing horse-traction by steam-traction, and several clever and well thought out traction engines are the result.

The boilers of these engines are usually constructed for burning straw, and the thrashed straw is delivered from a shoot alongside the fire-box, the firemen forking it into the furnace as required, the danger from accidental fire being reduced to a minimum.

These traction engines are made so that they can be used during harvest for hauling and working the combined harvester, they can then be used for hauling the grain in road trucks into market, and when ploughing time comes round they are used instead of horses for drawing the ploughs.

It will thus be seen that inventive genius is trying to provide for every condition and requirement, and experiments have been carried so far that traction engines are now built in California which will do all the hauling required in general farming and work on land which, whilst being very rich, is so soft and spongy that horses could not be used for drawing the combined harvested.

It is interesting to note how carefully the question of designing a traction engine to work on such land was thought out.

First a man of average weight walked over the land, and the depth of his foot prints was carefully noted. The area of his feet being

calculated, a basis was found for the area of the wheels required for a traction engine of a given weight to work on such land, and the result is that for some land the traction engines have wheels with tyres 4 feet wide, which give them the appearance of large road rollers, with this difference, that their road wheels are light in weight and fitted with wooden tyres.

Methods of combating Insect Pests in Orchards.

Considerable discussion has recently taken place in the Press regarding the relative merits of spraying and fumigation for the treatment of orchard pests. The Government Entomologist, who has been giving practical demonstrations in the latter process in various parts of the Colony, states that for all the kinds of scales, aphis, and surface eating insects the fumes act like magic in destroying these pests.

Orchardists, however, contend that the cost of the tents and the ingredients necessary for fumigation makes it too expensive to carry out on a large scale. Also they contend that the larvæ of the ladybirds and other scale-destroying insects are killed as well as the injurious insects.

The Fruit Expert, while admitting that the cost of fumigating outfit is high for the ordinary growers, thinks that a number of orchardists might combine and procure one outfit between them. This would materially reduce the expense, and as one fumigation would be as effective as three or four sprayings growers will in the end he thinks favour fumigation.

As to the destruction of friendly insects, about which much has been said, Mr. Allen agrees that certainly some of them will be destroyed, but he points out that New South Wales has given them a very fair innings, without so far obtaining any very beneficial result. The insect pests are not growing less under the benign supervision of the "friendly insects," and seeing the greatly increased value of clean over dirty fruit, Mr. Allen urges growers to combine and secure fumigating outfits and keep their trees clean.

Fumigation is especially necessary in plant nurseries, and all trees and plants should be thoroughly fumigated and insect pests destroyed before they are bundled up and sent away. It is from the nurseries that many of the pests have reached the orchards in the first instance, and had all nursery stock been cleansed thousands of pounds would have been saved to the growers.

Fumigation will also be found of especial value when a grower has a few trees badly diseased. These could be covered at once and treated cheaper and more effectually than by spraying. It is not, however, thought that fumigation will entirely do away with the spray pump which must remain a valuable adjunct to the property of many of the orchardists.

It will be a great pity, however, if the fumigator folds up his tents and the sprayman lets go the handle of his pump to argue about the merits of the two systems. If our orchards are to be worked at a profit the pests must be destroyed, and it really does not matter how

we set about the work so long as the death of insect foes is achieved. No doubt fumigation is about the most thorough method, and one likely to commend itself to a good many people who feel capable of handling with safety the deadly chemicals employed; but if a grower has already invested in a spray pump, and finds that he is getting good results, he would be foolish to bother about any other system. The trouble is that a good many fruit-growers are disposed to accept any excuse to put insect extermination off till—to-morrow.

THE INVASION OF LUCERNE BY A NEW SPECIES OF DODDER.

M. E. SCHRIBAUX, Director of the Institute for Seed Experiments at the National Agronomical Institute of France, writing to the *Journal de l' Agriculture* about the invasion of lucerne crops by a new species of *Cuscuta* (dodder or ringworm) says: The most dangerous diseases which have devastated our crops for the last fifty years—the potato disease, phylloxera, blackrot, and mildew, not to mention other less harmful—have all come to us from the other side of the Atlantic; the new foe to which I wish to call attention, the large dodder, being also of American origin. It is already making havoc among our lucerne, having been brought here among seed from Canada and the United States; this seed, which made its appearance in Europe nearly twenty years ago, having been immediately received into favour by the trade on account of its cheapness.

Led by a false spirit of economy, our agriculturists favoured its importation, ignorantly giving it the preference over our excellent French varieties, which, it is true, are more expensive, but which are very much superior as regards productiveness, besides resisting cold and cryptogamic diseases. The best of our clover and lucerne is sent to England and Germany, where the buyers do not hesitate to pay the full value for it.

When the Institute for experimenting with seeds was established, I called the attention of agriculturists to the invasion of the French markets by American forage seeds, and pointed out the dangers which threatened our cultivations from the frequent presence in American lucerne of large seeds of dodder, in such quantities that it was impossible to get rid of them by sifting. Both in the annual reports and in special pamphlets I have constantly reverted to this question.

No less than fifty years ago, the botanists mentioned a new species under the names of *Cuscuta suaveolens* (Seringe), *C. hassiaca* (Pfeiffer), *C. corymbosa* (Choisy). These three being originally American, but naturalised in Europe. Most likely this species was developed in districts not producing leguminous seeds, since it spread very little, being entirely unmentioned in agricultural publications. From 1884 to 1892 I never came across French lucerne infested with the large dodder, and the few specimens which were found presented every characteristic of American origin.

But starting from 1892 matters underwent a change. The importations from America, favoured by some bad crops, increased considerably.

In 1892–93 the proportion of samples containing the large dodder rapidly increased to 6·71 per 100 of the parcels examined at the Institute; in 1893–4 it increased to 9 per 100, and from this time we found it in lucernes having all the characteristics of lucerne from Provence.

It became a matter of importance at the Institute to ascertain if the large dodder had become established among our lucerne, and if its presence in a parcel of seeds ceased to characterise this as being of American origin. For this purpose I made a journey of several days in August, 1894, in order to examine the crops around Arles, assisted by M. Nüssbaum, member of the Society of Crau. I discovered the first patches of American dodder amongst some lucerne grown in the country. I communicated this information, so full of menace to the future of the Provence farms, to the large buyers and influential agriculturists in the district of Arles, impressing strongly on them the importance of inducing the Prefet of Bouches-du-Rhone to make the destruction of dodder obligatory. The evil evidently did not appear serious enough to them, as nobody seemed to trouble about the new parasite.

During the seasons 1894–5–6 the native lucernes seemed to improve, and the percentage of lots containing the large dodder fell to 2·81 and 1·98 per 100. In 1896–7 it rose again suddenly to 10·71 per 100.

In 1897–8, out of 624 samples, 102, 16·30 per 100, contained the American dodder. During the present season 74 out of 667, say, 11·9 per 100, were affected.

The following table gives the results at the Institute from 1892 to 1899:—

Years.	Samples Analysed.	Samples containing the American Dodder.	Proportion per 100.
1892–3	134	9	6·71
1893–4	200	18	9·00
1894–5	320	9	2·81
1895–6	303	6	1·98
1896–7	448	48	10·71
1897–8	624	102	16·30
1898–9	667	74	11·09

The increase of this scourge is thus very rapid, and the proportion of crops infested with the American dodder seems to us all the more alarming, inasmuch as our examinations were almost exclusively of choice seed sent to the Institute by agricultural syndicates, or by important firms (that is to say, samples having been specially and carefully cleaned and selected). During the last three years we have found the American dodder quite as frequently as the European variety, and within a very short time it will be universally spread if preventive measures are not taken.

We have cultivated the American dodder in the experimental fields at the Institute, and it has shown a most extraordinary vigour, developing during the course of the summer, in a walk close to one patch, filaments more than 3 feet in length.

At my request M. Nüssbaum compared the development in Provence with that of the European dodder, and found that the patches spread with equal, if not greater, rapidity. But it must not be forgotten

that the principal danger of the American dodder consists in the great size of the seeds, which renders their extraction impossible; the native species having much smaller seeds, which are easy to remove.

The American dodder thrives perfectly in the climate of Paris, and is, therefore, most dangerous in the districts where lucerne is cultivated.

M. Frauchet, to whom I express my sincere thanks, has compared the plants which we cultivated with the American types in the Museum collection, and has found that the dangerous dodder is the *Cuscuta Gronovii*, Wild, which is the one most prolific in N. America, from Canada down to Florida.

The following are its principal characteristics :—Strong yellow stems; large odorous white flowers, united in loose peniculated cymes; lobes of the corolla spread, generally shorter than the deep bell-shaped tube; shell much fringed; stigma hooded; large yellowish seeds, sometimes exceeding $\frac{1}{16}$ of an inch in diameter.

There is no doubt that besides the *Cuscuta Gronovii* other species in the American lucerne-seed will be found.

The specific characteristics on which different authors disagree have only a secondary interest for agriculturists.

I confine myself to calling attention to the fact that all the American dodders are of similar pattern, and are distinguished from our native dodders by larger flowers having hooded stigmas, and also by having larger seeds.

From experiments made it seems that the *Cuscuta Gronovii* cannot live on our field clover, but I have several times found the large dodder amongst the clover-seed from America, but no doubt this belongs to another variety.

To Boil Table Maize.

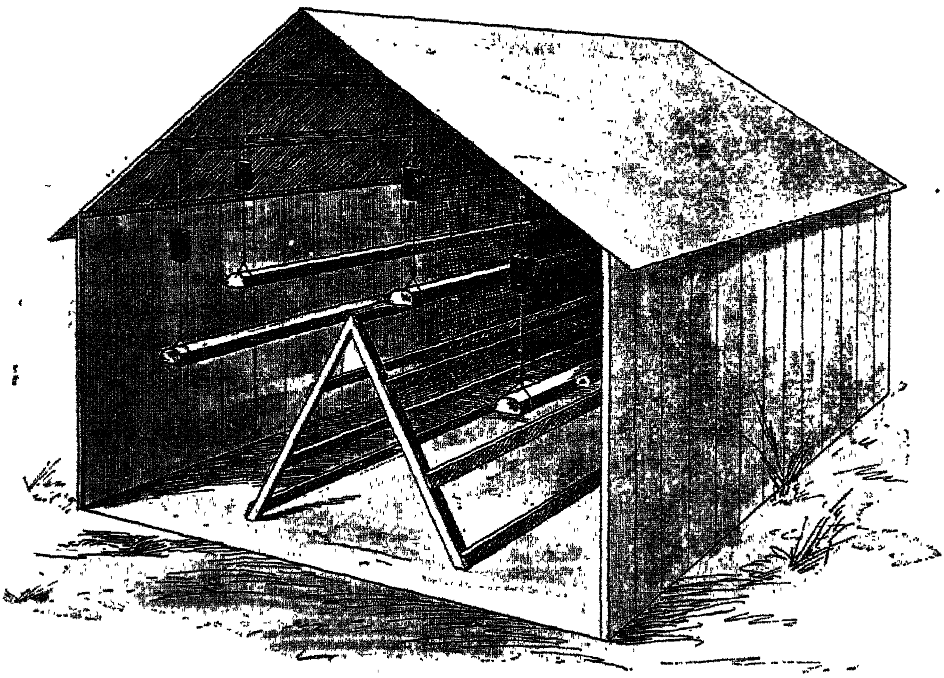
This is the season when one of the best vegetables we have is spoiled by ignorance and over-cooking. There is nothing so sweet, so delicate and delicious as an ear of corn properly cooked, and there is nothing more tasteless and unpalatable than corn when it has been boiled half an hour, and perhaps left soaking in water.

Do not cook your corn more than eight or ten minutes. Put it in a good-sized boiler which contains just as little water as can be kept from boiling away in the time it takes to cook the corn. Place the corn in crosswise—any way so that it will not be packed solidly together, but will leave room for the steam to circulate about each ear. Put a tight cover on the kettle, and a clean dish-towel over that, if necessary, to keep in the steam. Then cook for eight or ten minutes, and the result will be corn that is worth eating.

The trouble with most housekeepers is that they try to cook the cob. If the centre of the cob has a green look, they put the corn on to cook more. That is nonsense. Common sense shows that if the corn is only properly cooked, that big piece of woody substance inside it will not be, or that if the thick cob is cooked the corn will be overdone.—*Pacific Rural Press.*

A Louse-proof Roost.

The accompanying diagram from the *American Agriculturist* depicts a rattling good idea for protecting hen-roosts from invasion by lice or ticks, which are becoming so troublesome in many parts of this Colony. The plan is simply to suspend the roosts with wire, as recommended a little time ago by Mr. McCue; but, instead of using, as he



suggests, a bit of keroseney rag, get an old jam tin soldered on to each wire, forming a cup which can be kept filled with crude or pure kerosene, or even greasy water. The same arrangement might be used for hanging safes, to prevent the inroads of ants.

Sweating Grain.

It very often happens that grain stored in bins begins to sweat, and becomes mouldy in consequence. A simple remedy for this is suggested in the *American Cultivator.* It is to drive the hand deep into the mass of grain occasionally, and, if it feels abnormally warm (if a thermometer is handy, and is used, when the temperature indicated is over 100° F. there is something wrong), some ordinary bricks, thoroughly dried in the oven, should be placed in the bin. The bricks will speedily absorb the moisture, which leads to mould, and keep the grain in good condition.

Preservation of Stable Manure.

In a paper read before the last annual convention of the Cheese and Butter Association of Western Ontario, Mr. Frank T. Shutt, M.A., Chemist of the Dominion Experimental Farms, Canada, took up a subject which is of the greatest importance to farmers who wish to get the best results from their stores of farm-yard manure. After showing how necessary it is that farmers should make themselves acquainted with the nature and composition of manures produced by the different classes of live stock, and the conditions and influences that increase or decrease the fertilising value of it, Mr. Shutt detailed certain experiments recently carried out at the Experimental Farm at Ottawa in connection with the rotting of manure. In this experiment or investigation the principal object was to learn what losses took place in nitrogen, phosphoric acid, and potash during the rotting of manure under two conditions—(*a*) manure completely protected from the weather, and (*b*) manure rotted in an open bin, using all ordinary precaution against undue leaching. Secondly, to learn the result of fermentation upon the availability of the plant-food in the manure. This is an important question, for it is quite possible to have the soil loaded or saturated with the elements of plant-food, nitrogen, phosphoric acid, and potash, but so combined that they are of comparatively little value to growing crops, that is to say, are not soluble in water. We are all aware that the nourishment crops take through their roots must be in solution. Plant-food to be available must either be in solution or soluble in the slightly acid sap which roots exude. Plant-food in other forms than these is not available for our growing crops. For instance, in various parts of Canada phosphate of lime or apatite is mined. This mineral phosphate, no matter how finely it is ground out, is useless (because insoluble) to growing crops. It had been tried and that conclusion had been reached after several years of experimenting. But treat this mineral phosphate with sulphuric acid, and it is converted into super-phosphate, a most valuable, because soluble, source of phosphoric acid for crops. It was desired to learn therefore whether fermentation under the conditions named affected in any way the availability of the plant-food in the manure.

"Equal weights of horse and cow manure, 4 tons of each, were intimately mixed. A sample of this mixed manure was taken and analysed. This gave the composition of the manure at the beginning of the experiment. Then the 8 tons were divided into two equal parts, and 4 tons were placed in a small building that was weather-proof, and compressed by pounding; the other 4 tons were placed in an open bin. In this bin the manure was exposed to every rain that fell, but the sides and floors being constructed of double boarding, all due precaution against the leaching was taken. From month to month, for a whole year, both these manures were weighed and sampled. The samples were then submitted to careful analysis, and from the figures obtained the losses which might have occurred were calculated, both in the 'protected' and 'exposed' manures. From

these figures it is possible to say whether the plant-food in either of the manures had become more available. The following chart will show clearly the results arrived at:—

WEIGHTS OF FERTILISING CONSTITUENTS IN "PROTECTED" AND "EXPOSED" MANURES.

	Fresh.		At the end of 3 months.		At the end of 6 months.		At the end of 9 months.		At the end of 12 months.	
	Protected.	Exposed.	Protected.	Exposed.	Protected.	Exposed.	Protected.	Exposed.	Protected.	Exposed.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Weight of manure ...	8,000	8,000	2,980	3,903	2,308	4,124	2,224	4,189	2,185	3,838
Organic matter	1,938	1,938	880	791	803	652	760	648	770	607
Total nitrogen	48	48	40	34	39	33	37	29	37	31
*Total phosphoric acid ...	25	25	25	23	26	22	25	21	24	21
†Available phosphoric acid	15	15	20	15	19	15	21	17	19	16
*Total potash	62	62	65	48	59	44	60	41	60	40
†Available potash ...	54	54	62	45	52	42	56	38	55	35

* Soluble in strong hydrochloric acid. † Soluble in dilute citric acid.

Further, in addition to determining the total amounts of those elements enumerated, the amounts of such as were converted into compounds more available for plant absorption, were estimated month by month. This is an important matter, as these constituents are of practically but little value to crops until they have been so converted.

Mr. Shutt adds :—"In considering the charts, I wish, first, to call attention to the richness of the fresh manure as produced on the Experimental Farm, Ottawa, compared with manures ordinarily found in the barnyards throughout the country.

	Average on Farms lb. per on.	C. E. F. lb. per ton.
Nitrogen	7·8	12·0
Phosphoric Acid	3·6	6·1
Potash	9·0	15·3

"You will notice that there is a very great difference in favour of the C. E. F. manure. I attribute it chiefly to the greater care of the liquid manure on the Experimental Farm. We know that the liquid manure is by far the richer in nitrogen and potash, and I cannot impress upon you too strongly the desirability of using sufficient absorbent litter to hold all the urine. This is a matter in which tons of most valuable plant-food are annually lost by farmers.

"By referring to chart No. 1, you will notice there was a continuous loss in weight, both in the 'protected' and 'exposed' manures, throughout the period of the experiment. This loss was largely due to the destruction of the organic matter by fermentation. This is made clear by comparing the amounts of organic matter present, month by month. During the first three months the 'protected'

manure lost 1,058 lb., and the 'exposed' manure 1,147 lb. organic matter. At the end of the year the organic matter in the former had been reduced to 770 lb., in the latter to 607 lb.

"Secondly, there is a similar (though not so great) loss of nitrogen. From 48 lb. in the 'protected' the nitrogen was reduced to 40 lb. in three months; in the 'exposed' the nitrogen fell from 48 lb. to 34 lb. in the same period. Again we notice, then, the greater loss in the manure fermented without protection.

"Thirdly, as regards phosphoric acid, it is to be observed that practically there is no loss in the protected manure; in the exposed manure 4 lb. of the 25 lb. originally present were lost by drainage.

"Considering the effect of fermentation upon the availability of the phosphoric acid it will be seen that in the protected manure the amount of such available phosphoric acid increased. This I deem a matter of considerable moment.

"Fourthly, in speaking of potash we have again to record the fact that practically there was no loss in the protected manure. The case, however, is very different in the exposed manure. Although precautions were taken against undue leaching, by providing the bin with double flooring, yet nevertheless there was a great loss of this element by soakage. It must be remembered that the potash of manure exists for the greater part in the urine, and consequently is present in solution. This exposed manure lost 22 lb. out of 62 lb. originally present—more than one-third. It seems to me that from a consideration of this experiment we may conclude that there will always be some loss on keeping manure unless it is preserved on a cement floor. In thinking over these results I would like every farmer to ask himself if the conditions under which he rots manure are as good as those of the exposed bin of this experiment. If not, his loss of potash will be greater than that we sustained.

"In the following chart we have given the percentages of the fertilising constituents lost under the two systems of rotting, and also stated the loss in value per ton that these manures sustained. This table is a most instructive one, and worthy of careful study.

Loss of Fertilising Constituents in the Rotting of Manure.

	At end of 3 months.		At end of 6 months.		At end of 9 months.		At end of 12 months.	
	Protected.	Exposed.	Protected.	Exposed.	Protected.	Exposed.	Protected.	Exposed.
	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.	p. c.
Loss of organic matter	55	60	58	65	60	67	60	69
,, Nitrogen	·17	29	19	30	23	40	23	40
,, Phosphoric acid	none	8	none	12	none	16	4	16
,, Potash	none	22	3	29	3	34	3	36
Loss in value per ton of original manure.	20c.	64c.	27c.	80c.	36c.	90c.	36c.	95c.

Value of fresh manure, \$2.61 (10s. 10½d.) per ton.

CONCLUSIONS.

1. Fermentation causes loss. In both instances there was loss by destruction of organic matter and nitrogen, though the loss of these constituents was much greater in the exposed than in the protected manure. By rotting we must allow that the organic matter is converted into compounds that more readily form humus in the soil, and this is certainly an advantage. It is an offset against the loss we have mentioned.
2. There was no loss of phosphoric acid in the protected manure, but the exposed manure suffered loss in this element. Rotting had a useful effect in rendering the phosphoric acid more available.
3. Though practically no potash was lost from the protected manure, more than one-third the amount of this valuable element was lost by drainage in the exposed manure.
4. Rotting does not affect the availability of the potash; in other words, the potash of fresh manure is just as valuable as plant-food as that in rotted manure.
5. There appears to be no object in rotting manure for a longer period than three months.
6. The best conditions for rotting necessitate (1) protection from rain, sun, and wind, (2) a water-tight cement floor, and (3) that the mass of manure be kept moist and compact.
7. Weight for weight, well rotted manure is much richer in plant food than fresh manure.
8. Rotting manure destroys weed-seeds that may be present.

In answer to a question as to whether it would not be better for the farmer to use manure in the green state, unless he has foul seed in it, and he should then ferment it to destroy the seed, Mr. Shutt said:—"Not necessarily. For certain crops and certain soils it is better to have rotted manure, though it may not be possible to rot the manure without some loss; but if he is not prepared to have such arrangements whereby the manure is protected and preserved from leaching, and if he is not prepared to keep the manure moist and compact, then it is better for him to get that manure into the ground as soon as possible. It seems to be the opinion of most practical men that heavy clay loams are those which benefit most by fresh manure. There is no doubt that the soil is a storehouse which prevents loss of the fertilising material of the manure. Clay loams are very much improved in their mechanical condition by the application of fresh manure. On the other hand, for light and sandy soils, rotted manures are probably the best. In working light and leachy soils it seems to be the greater economy to feed the crop rather than to try to improve the soil; in other words, to apply the manure annually in the rotted condition. For such soils there is nothing better than a leguminous crop turned under. This is the cheapest way of permanently improving such soils."

Replies to Correspondents.

Bordeaux Mixture for Peach Freckle.

A CORRESPONDENT writes, that in his experiments with Bordeaux mixture (very carefully prepared) for peach freckle, the fruit and leaves of some of the trees were destroyed.

The fruit expert, Mr. Allen, reports that in using Bordeaux mixture on tender foliage, unless the climatic conditions are absolutely favourable, it is well to always be on the safe side and dilute the 40 gallon mixture up to 45 or even 50 gallons of water.

Mr. Allen also wishes fruit-growers intending to fumigate while trees are making new growth to note that not more cyanide than 1 oz. to 200 cubic feet tent-space should be used.

Variegated Thistles.

MR. A. J. BENNETT, of Oaklands, asks for advice as to the best way of getting rid of variegated thistles. He wants to know whether hoeing them down and converting them into stack ensilage would be successful.

Mr. Geo. Valder, Principal of the Hawkesbury Agricultural College, says the variegated thistle is an excellent fodder plant, and no better means of utilising it could be suggested than that proposed. Mr. Valder has seen several samples of variegated thistle silage and they were all of splendid quality. As a rule, the product when taken out of the stack does not smell very savoury, but when ever the stock get a taste of it you cannot give them enough.

This is no doubt due to the fact that there is a large amount of mineral matter in this plant, much of it salt, which renders it particularly palatable.

Lumpy Jaw and Tuberculosis.

MR. BENNETT also enquires whether any cattle affected with actinomycosis or lumpy jaw, have undergone the tuberculin test and with what results.

Lumpy jaw is certainly often mistaken for tuberculosis, but it can readily be diagnosed by a veterinary surgeon. Cattle affected by lumpy jaw only will not respond to the tuberculin test for tuberculosis, but it is quite possible for an unfortunate beast to have both troubles at the same time.

AGRICULTURAL SOCIETIES' SHOWS, 1899.

Society.	Secretary.	Date.
Dapto A. and H. Society ...	A.B. Chippindall	Jan. 11, 12
Lismore A. and I. Society ...	T. W. Hewitt...	,, 18, 19
Gosford A. and H. Association ...	W. McIntyre ...	,, 20, 21
Kiama Agricultural Association ...	J. Somerville ...	,, 25, 26
Wollongong Agricultural Association ...	J. A. Beatson ...	Feb. 1, 2, 3
Moruya A. and P. Society ...	J. Jeffery ...	,, 7, 8
Manning River A. and H. Association ...	W. Plummer ...	,, 9, 10
Liverpool Agricultural Society ...	J. E. Wilson and G. L. Sutton, Hon. Secs.	,, 9, 10, 11
Berrigan Autumn Show ...	R. Drummond...	,, 15
Ulladulla A. and H. Association ...	C. A. Cork ...	,, 15, 16
Lithgow A. H. and P. Society ...	M. Asher ...	,, 16, 17
Hornsby, Thornleigh, Pennant Hills, Beecroft, and Carlingford H. Society ...	E. H. Sargent...	,, 17, 18
Tumut A. and P. Association ...	M. McNamara ..	,, 22, 23
Alstonville A. Society ...	N. R. Elvery ...	,, 22, 23
Port Macquarie and Hastings A. and H. Society ...	J. Y. Butler ...	,, 23, 24
Bega A., P., and I. Society ...	John Underhill..	Mar. 1, 2
Glen Innes-Armidale Combined Show (Glen Innes) ...	John Priest ...	,, 1, 2
Robertson Agricultural and Horticultural Society ...	R. G. Ferguson	,, 2, 3
Upper Murray (Tumbarumba) P. and A. Society ...	W. Willans ...	,, 7, 8
Tenterfield Intercolonial P., A., and M. Society ...	T. W. Hoskin...	,, 7, 8, 9, 10
Cudal A. and P. Society ...	C. Schramme ...	,, 8
Liverpool Plains P., A., and H. Association (Tamworth)	T. R. Wood.....	,, 8, 9
Oberon A. H. and P. Association...	Alfred Gale ...	,, 9, 10
Berrima District (Moss Vale) A., H., and I. Society ...	H. Richardson...	,, 9, 10, 11
Castle Hill and District A. and H. Association...	F. H. Rogers ...	,, 10, 11
Cobargo A., P., and H. Society ...	T. Kennelly ...	,, 14, 15
Southern New England P. and A. Association (Uralla)..	P. M. O'Connor.	,, 14, 15
Inverell P. and A. Association ...	John McGregor	,, 15, 16, 17
Nepean District (Penrith) A., H., and I. Society ...	E. K. Waldron..	,, 16, 17
Gundagai P. and A. Society ...	A. Elworthy ...	,, 16, 17
Goulburn A., P., and H. Society ...	J. J. Roberts ...	,, 16, 17
Candelo Agricultural Association ...	C. H. Brooks ...	,, 16, 17
Cummock P. A. and H. Association ...	W. L. Ross ...	,, 17, 18
Walcha P. and A. Association ...	F. Townshend...	,, 21, 22
Blayney A. and P. Association ...	H. Woolley ...	,, 22, 23
Upper Hunter (Muswellbrook) Agricultural Society ...	J. C. Luscombe	,, 22, 23, 24
Camden A., H., and I. Society ...	C. A. Thompson	,, 22, 23, 24
Bangalow A. and I. Society ...	John R. Wilson	,, 23, 24
Crookwell P. and A. Association ...	M. P. Levy ...	,, 23, 24
Warialda P. and A. Association ...	W. B. Geddes...	April 5, 6
Gulgong A. and P. Association ...	C. E. Wilton ...	,, 7, 8
Mudgee Agricultural Society ...	J. M. Cox ...	,, 11, 12, 13
Cooma P. and A. Association ...	C. J. Walmsley	,, 12, 13
Clarence P. and A. Association ...	Jas. C. Wilcox..	,, 13, 14
Lower Clarence Agricultural Society (Maclean)...	G. Davis ...	,, 18, 19
Richmond River (Casino) A., H., and P. Society ...	Jas. Tandy ...	,, 19, 20
Hunter River A. and H. Association ...	W. C. Quinton..	,, 19, 20, 21
Orange A. and P. Association ...	W. Tanner, jun.	April 26, 27, 28
Wellington P. and A. Society ...	R. Porter ...	May 2, 3
Upper Manning Agricultural and Horticultural Assoc.	...	,, 4, 5
Coonamble P. and A. Association...	F. C. Lamotte...	,, 10, 11
Dubbo P. A. and H. Association ...	H. Munckton ...	,, 9, 10
Hawkesbury District A. Association (Richmond) ...	C. S. Guest ...	,, 11, 12, 13*
Mudgee Agricultural Society ...	J. M. Cox ...	,, 16, 17
Walgett P. and A. Association ...	Thos. Clarke ...	,, 17, 18
Durham A. and H. Association ...	C. E. Grant ...	,, 17, 18
Deniliquin P. and A. Society ...	H. J. Wooldridge	July 19, 20
Moree P. and A. Society ...	S. L. Cohen ...	,, 19, 20, 21
Condobolin P. and A. Association...	H. W. Grey-Innes	,, 26, 27
Riverina (Jerilderie) P. and A. Society ...	W. Elliott ...	August 1, 2
Forbes P. A. and H. Association ...	N. A. Read ...	,, 1, 2

Society.	Secretary.	Date.
Parkes A. and H. Association	J. H. Lane ..	August 9, 10
Narandera P. and A. Association	J. F. Willans ...	,, 9, 10
Corowa P. A. and H. Society	E. L. Archer ...	,, 15, 16
Manildra P. and A. Association Ploughing Matches and Exhibition	G. W. Griffith...	,, 16
Northern Agricultural Association (Singleton)	C. Poppenhagen	,, 16, 17
Murrumbidgee P. and A. Association (Wagga)... ...	H. B. Greene ...	,, 23, 24, 25
Grenfell P., A., and H. Society	Geo. Cousins ...	,, 24, 25
Cootamundra A. P. H. and I. Association	T. Williams ...	,, 29, 30, 31
Moree P. and A. Society	S. L. Cohen	,, 30, 31 September 1
Junee P. A. and I. Association	T. C. Humphrys	,, 6, 7
Moama A. and P. Association	C. L. Blair ...	,, 13
Albury and B. P. A. and H. Society	Geo. E. Mackay	,, 13, 14, 15
Cowra P., A., and H. Association	F. H. Piddington	,, 20, 21
Germanton P. A. and H. Society	G. T. S. Wilson	,, 20, 21
Yass P. and A. Association...	W. Jermyn ...	,, 21, 22
Temora P., A., H. and I. Association	W. H. Tubman	,, 27, 28
Burrowa P. A. and H. Association	F. H. Tout ...	,, 28, 29
Queanbeyan P. and A. Association	A. W. Moriarty	,, 28, 29
Holt-Sutherland H. and P. Society (Miranda)	E. Thacker ...	October 2
Berry A. Association	A. J. Colley ...	Dec., 6, 7, 8

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Dapto A. and H. Society	A. B. Chippindall	Jan., 10, 11
Thornleigh and District Horticultural Association ...	Fred. N. Brack...	,, 12, 13
Albion Park A. and H. Association	H. Tryer ...	,, 17, 18
Wollongong Agricultural Association	J. A. Beatson	,, 31, Feb., 1, 2
Alstonville Agricultural Society	N. R. Elvery ...	,, 14, 15
Moruya A. and P. Society...	John Jeffery ...	,, 14, 15
Robertson A. and H. Society	R. J. Ferguson ...	,, 29, Mar. 1
Cobargo A. P. and H. Society	T. Kennelly ...	Mar. 1, 2
Tenterfield I. P. A. and M. Society, Show	T. W. Hoskin ...	,, 6, 7, 8
,, ,, Fair days	,, ...	,, 9, 10
Candelo A. Association	C. H. Brooks ...	,, 7, 8
Oberon A. H. and P. Association	Alf. Gale ...	,, 8, 9
Berrima District A. H. and I. Society (Moss Vale) ...	James Yeo ...	,, 8, 9, 10
Campbelltown A. H. and I. Society	A. R. Payten ...	,, 9, 10
Lismore A. and I. Society	T. W. Hewitt ...	,, 7, 8
Bega A. P. and H. Society...	J. Underhill ...	,, 14, 15
Central New England (Glen Innes) P. and A. Assoc. ...	John Priest ...	,, 14, 15, 16
Nepean District A., H., and I. Society	E. K. Waldron...	,, 14, 15, 16
Cumnock P., A., and H. Association	W. L. Ross ..	,, 20, 21
Armidale and New England P., A., and H. Association	W. H. Allingham	,, 20, 21, 22
Mudgee Agricultural Society	J. M. Cox ...	,, 21, 22, 23
Inverell A. and P. Society..	J. McGregor ...	,, 21, 22, 23
Camden A., H., and I. Society	C. A. Thompson..	,, 21, 22, 23
Crookwell P. and A. Association...	J. W. P. Levy ...	,, 22, 23
Liverpool Plains P., A., and H. Association (Tamworth)	J. R. Wood ...	,, 27, 28, 29
Clarence P. and A. Society (Grafton)	J. C. Wilcox ...	,, 28, 29
Blayney A. and P. Association	H. Woolley ...	,, 28, 29
Gundagai P. A. H. and I. Society	A. Elworthy ...	,, 29, 30
Castle Hill and District A. and H. Association... ...	F. H. G. Rogers	April 4, 5
Cooma P. and A. Association	C. J. Walmsley	,, 4, 5
Upper Hunter (Muswellbrook) P. and A. Association ..	J. C. Luscombe..	,, 4, 5, 6
Orange A. and P. Association	W. Tanner, junr.	,, 4, 5, 6
Warialda P. and A. Association	W. B. Geddes ...	,, 4, 5
Royal Agricultural Society of New South Wales ...	F. Webster ...	,, 11-16
Richmond River A., H., and P. Society (Casino) ...	Jas. T. Fandy ...	,, 11, 12
Hunter River A. and H. Association (West Maitland)...	W. C. Quinton...	,, 25, 26, 27

* Entries close 20th April.

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